Quality-Based Analysis Capability for National Youth Surveys

Development, Application, and Implications for Policy

Bruce R. Orvis, Martin T. Gahart

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The research described in this report was sponsored by the Office of the Assistant Secretary of Defense (Force Management and Personnel) under a Federally Funded Research and Development Center relationship with the Office of the Secretary of Defense under Contract No. MDA903-85-C-0030.

Library of Congress Cataloging in Publication Data

Orvis, Bruce R.

Quality-based analysis capability for national youth surveys : development, application, and implications for policy / B.R. Orvis, M.T. Gahart.

p. cm.

"Prepared for the Office of the Assistant Secretary of Defense/Force Management and Personnel."

"March 1989."

Bibliography: p.

"R-3675-FMP."

ISBN 0-8330-0918-4

1. United States—Armed Forces—Recruiting, enlistment, etc. 2. Youth—United States. I. Gahart, Martin T. II. RAND Corporation. III. United States. Office of the Assistant Secretary of Defense/Force Management and Personnel. IV. Title.

UB323.0785 1988

355.2'2—dc19 88-30115

CIP

Published by The RAND Corporation
1700 Main Street, P.O. Box 2138, Santa Monica, CA 90406-2138

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER R-3675-FMP	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Quality-Based Analysis Capability for National Youth Surveys		5. TYPE OF REPORT & PERIOD COVERED interim 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) B. R. Orvis, M.T. Gahart		8. CONTRACT OR GRANT NUMBER(s) MDA903-85-C-0030
9. PERFORMING ORGANIZATION NAME AND ADDRESS The RAND Corporation 1700 Main Street Santa Monica, CA 90406		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS Ofc, Asst Secty of Defense for Force Management & Personnel Washington, D. C. 20301-4000		12. REPORT DATE March 1989 13. NUMBER OF PAGES 98
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public Release; Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

No Restrictions

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Surveys
Youth
Recruits
Aptitude Tests

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

see reverse side

DD FORM 1 JAN 73 1473

Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

This report develops and applies a method of using the information contained in national youth surveys to estimate the probability that respondents would score at or above the 50th percentile (categories I-IIIA) on the Armed Forces Qualification Test. The method can be applied for a variety of purposes, e.g., to estimate and compare results for high-aptitude vs. low-aptitude respondents or to explore findings of interest for high-quality youths. It is possible to compare the estimated responses of high-aptitude and low-aptitude youths for factors such as background characteristics, enlistment propensity, future plans, recruiter contacts, and awareness of military advertising and enlistment incentives, and to examine the interrelationships among these factors. The method also provides a means of estimating the proportion of high-aptitude youths in the surveyed population as a whole or in subgroups of special interest.

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PREFACE

As part of the military recruiting effort, the Department of Defense regularly sponsors surveys of the national youth population. The purpose of such surveys is to provide information that can be used in designing recruiting and advertising strategies. However, given the military's interest in recruiting high quality youths—i.e., high school diploma graduates who score at or above the 50th percentile (categories I-IIIA) on the Armed Forces Qualification Test (AFQT)—most of the surveys have an important shortcoming: they do not identify the AFQT scores of the respondents. As a consequence, researchers are unable to focus their analyses of the survey data on the subgroup of primary interest.

This report develops and applies a method of using the information contained in national youth surveys to estimate the probability that respondents would score in categories I-IIIA if they took the AFQT. The method can be applied for a variety of purposes: for example, to estimate and compare results for high versus low aptitude respondents or to explore findings of interest for high quality youths. It is possible to compare the estimated responses of high and low aptitude youths for factors such as background characteristics, enlistment propensity, future plans, recruiter contacts, and awareness of military advertising and enlistment incentives, and to examine the interrelationships of these factors. The method also provides a means of estimating the proportion of high aptitude youths in the surveyed population as a whole or in subgroups of special interest.

The research was sponsored by the Office of the Assistant Secretary of Defense for Force Management and Personnel. The report was prepared within RAND's Defense Manpower Research Center. The Center is a component of RAND's National Defense Research Institute, an OSD-sponsored Federally Funded Research and Development Center.

SUMMARY

This report describes the development of a quality-based analysis capability for the Youth Attitude Tracking Study (YATS)—the primary recruiting-related survey sponsored on an ongoing basis by the Department of Defense—and applies it to selected results from the 1985 YATS survey. The method is applicable to all surveys of the national youth population similar to the YATS that provide appropriate respondent background information.

DEVELOPMENT OF AFQT CATEGORY ESTIMATION METHOD

Our approach was shaped by military recruiting policy and the characteristics of the YATS database. First, given the services' interest in recruiting Armed Forces Qualification Test (AFQT) category I-IIIA youths, we developed models to estimate the probability that an individual would score at or above the 50th percentile if he took the test. Second, separate models were constructed for high school students and individuals no longer in high school, since previous research has shown that high school students and persons no longer in high school differ in fundamental ways in enlistment decisionmaking. Finally, only about 20 percent of male YATS respondents take the AFQT, and their characteristics differ from those of persons who do not test. The nonrepresentativeness of AFQT-takers means that statistical procedures that simply model the AFQT scores of test-takers may produce biased coefficients for the population as a whole. To deal with this problem, we employed a two-equation, maximum likelihood estimation procedure that accounts for an individual's probability of taking the AFQT and the correlation between the error terms in the testing and AFQT equations.

Our primary database contains results from the fall YATS survey waves administered in 1976–1980. Military Entrance Processing Station (MEPS) Reporting System (MRS) records were merged with the YATS data to supply AFQT information for respondents who tested. The MRS information was available through March 1985, and thus provided a follow-up period of at least four and one-half years. The variables used to develop the AFQT estimates are enduring components of the YATS and are known from prior research to be related to the likelihood of testing, to AFQT score, or to both. In general

terms, they assess background characteristics, economic factors, educational experience, and military interest.

Consistent with the results of prior research, we found that measures of academic success and father's education predict scoring in categories I-IIIA. Also as expected, white non-Hispanics are more likely than other racial groups to score at or above the 50th percentile, as, in general, are youths not residing in the South. In comparison with high school graduates who are not in college, nongraduates are less likely to score in categories I-IIIA, whereas graduates attending college are more likely to do so.

Two types of analyses were conducted to assess the accuracy and reliability of the estimation procedure. Both involved comparisons of predicted AFQT values with the actual results of persons who tested. One analysis compared the proportion of AFQT-takers actually scoring in categories I-IIIA with the test-takers' predicted probability of doing so. The second compared the actual and predicted characteristics of category I-IIIA test-takers. Each analysis was made for two datasets. To check the method's accuracy, we analyzed results from the survey waves used to construct the equations (fall 1976–1980). To assess its reliability, we analyzed results from the spring 1976–1980 YATS surveys.

The analyses show that the AFQT estimation method produces accurate results. The respondents' predicted probabilities of scoring in categories I-IIIA are in close agreement with actual test results for both the high school student and non-high school student models. For example, among young men predicted to have a probability of scoring in categories I-IIIA of only .10 or less, the actual proportion scoring in those categories was .07 in both models. In contrast, among persons predicted to have a probability of scoring in categories I-IIIA above .90, the actual proportion scoring in those categories was .93 in the high school model and .92 in the non-high school model. The predicted and actual background characteristics of category I-IIIA test-takers—such as region of residence and employment status—also correspond closely. The results of the reliability analysis lend additional support to the usefulness of the AFQT estimation method. Although the accuracy of the estimation procedure is reduced somewhat when applied to the spring 1976–1980 YATS dataset, the distribution of predicted probabilities of scoring in categories I-IIIA closely approximates the actual test results for both high school students and those no longer in high school, and the predicted and actual background characteristics of category I-IIIA test-takers again correspond closely.

Women were not included in the YATS until fall 1980. Given the limited number of female respondents, the brevity of the follow-up

period possible for women, and their low AFQT testing rate—about 5 percent—it was difficult to develop AFQT equations for females. On the basis of an extensive exploratory analysis, we concluded that the best option was to use the AFQT models developed for men, eliminate or combine variables with small frequencies, and generate new parameter estimates for women. These models produced satisfactory results.

APPLICATION OF METHOD

The AFQT estimation procedure gives researchers the ability to conduct a quality-based analysis of survey results to provide information on the characteristics of different aptitude groups and to explore data of potential use in targeting recruiting and advertising resources to high quality youths. To illustrate the potential of this approach, we conducted such an analysis for young male respondents to the 1985 YATS survey. For reasons both of recruiting policy and behavior differences, the YATS results were analyzed for four major groups according to high school status. The groups were: (1) high school diploma graduates; (2) high school seniors; (3) younger high school students; and (4) nongraduates, i.e., individuals without high school diplomas who were not continuing in high school. Results for each of the graduate and student groups were estimated for two subgroups: AFQT category I-IIIA and AFQT category IIIB-V. Because of its lower recruiting priority, the nongraduate group's results were not analyzed by subgroup.

The analysis showed large differences in stated enlistment propensity levels among the school groups and between the aptitude subgroup estimates. Propensity to enlist was much greater for high school students than for high school graduates. Overall, about 35–40 percent of the students reported positive propensity, compared to just under 20 percent of the graduates. Also, enlistment propensity was estimated to be much lower for AFQT category I-IIIA youths than for category IIIB-V youths. Positive propensity estimates for category I-IIIA high school students were nearly 15–20 percentage points lower than for category IIIB-V students; the corresponding difference among high school graduates was nearly 15 percentage points.

Differences in stated enlistment propensity were reflected in the rates of taking actions toward enlistment: in general, lower AFQT youths appear to be more likely than higher AFQT youths to take such actions. However, differences between the AFQT groups were not large in absolute terms, never exceeding 5 percentage points. For the Army and the Marine Corps, recruiter contacts with AFQT category I-IIIA

youths appear to be less common than contacts with category IIIB-V youths. This suggests that some action to increase recruiter contacts among category I-IIIA youths may be desirable. For the Navy and Air Force, recruiter contact rate estimates were generally comparable for the two AFQT groups.

The military appears to compete with full-time school attendance for the majority of category I-IIIA youths. For lower aptitude youths, the opportunity to recruit from the school and labor markets appears more balanced. Encouragingly, among high school graduates, category I-IIIA youths planning to attend school full-time in the future appear to have comparable enlistment propensity to those planning to work full-time. Among high school students, however, they have lower propensity.

Overall, there was high awareness of recent advertising for the military. About 80–90 percent of the respondents recalled seeing or hearing broadcast advertising for the military during the past year. Awareness of print advertising was 5–10 percentage points lower, whereas reports of receiving unsolicited recruiting literature were less common. The three media combined appeared to cover about 95 percent of the market with military advertising. Media coverage for the individual services and components varied considerably and was much lower overall. Coverage estimates averaged about 80–85 percent of high school graduates and seniors in AFQT categories I-IIIA for the Army, 65–70 percent for the Marine Corps and Air Force, and 60 percent for the Navy. The results are reassuring in suggesting that as many AFQT category I-IIIA youths as category IIIB-V youths were reached by advertising efforts. However, large proportions of category I-IIIA high school graduates and seniors appeared to be unaware of recent advertising for most services.

Only 25 percent of the respondents could closely estimate military starting pay. However, the data provide little evidence of differential knowledge of pay by AFQT group or that increasing awareness of pay would increase enlistment interest. Similarly, only 27 percent of the respondents were aware of enlistment bonuses, and they seriously underestimated the bonuses' cash value. There was little evidence of differential awareness by AFQT group. Given the uniformly low awareness level, advertising the availability of enlistment bonuses and their cash value might be beneficial. Awareness of educational benefits was much greater. Two-thirds of the respondents overall and 75 percent of category I-IIIA high school graduates and seniors appeared to be aware of the post-service educational benefit program. However, the maximum value of the benefit was underestimated considerably. The results suggest that advertising that includes information on the benefit's dollar value might be beneficial.

Various job characteristics assessed in the YATS were analyzed according to their perceived importance and availability in military versus civilian jobs. Results for all the school-AFQT groups were similar. Job security, learning a skill or trade, retirement benefits, and, to a lesser extent, getting money for education and promotion opportunities were perceived to be both important and more available in military jobs. Other results suggest that, where feasible, advertising might be directed at increasing the perceived **availability** of enjoying your work, personal freedom, and good income in military jobs. Advertising efforts might be directed at increasing the perceived **importance** of equal pay and opportunity for men and women, doing something for your country, being trained for leadership, and having status and prestige. Finally, having a lot in common with co-workers, staying in your area, and parents' approval were rated as both less available in military jobs and not especially important. Advertising for these characteristics may be more difficult and less useful.

ACKNOWLEDGMENTS

This study was made possible by the support of W. S. Sellman, Director for Accession Policy, OASD(FM&P), and Zahava Doering, then Chief, Survey and Market Analysis Division, Defense Manpower Data Center (DMDC). We are also grateful to Kyle Johnson and Michael Laurence, who worked with us at various stages of this project, and to Robert Brandewie, Helen Hagan, and Leslie Willis, all of DMDC, who provided the primary database used in this research.

At RAND, we are grateful to our colleagues Robert Bell, Glenn Gotz, and James Hosek, and to Karl Schutz and Don Waldman (both formerly of RAND) for their advice and support. We are also grateful to Beth Asch and John Winkler for their helpful reviews of this report and to Jeanne Heller, our editor. Special thanks are due to Richard Buddin, for his assistance throughout this project. Finally, credit must go to Marilyn Yokota, for her invaluable help in the preparation of this report.

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I. INTRODUCTION

BACKGROUND

During the past several years, the military services have become increasingly interested in recruiting "high quality" youths—high school diploma graduates who score at or above the 50th percentile (categories I-IIIA) on the Armed Forces Qualification Test (AFQT). This trend is likely to continue, given the lower attrition rates of high quality enlistees (Buddin, 1984), the declining size of the youth cohort, and concerns about the skill requirements and training costs associated with the introduction of complex new equipment into the military inventory. It is important to continue to recruit the most able youths available. As part of the recruiting effort, the Department of Defense regularly sponsors surveys of the national youth population. The purpose of these surveys is to provide information that can be used in designing recruiting and advertising strategies. However, given the military's interest in high quality youths, most of the surveys have an important shortcoming: they do not identify the AFQT scores of the respondents. As a consequence, researchers are unable to use the survey results to provide specific data summaries for the subgroup of primary interest.

The ability to analyze survey results according to AFQT category would allow researchers to compare findings between AFQT categories and to explore results that may be useful in targeting recruiting and advertising resources for high quality youths. Factors that could be examined using this type of analysis include background and demographic characteristics, enlistment propensity, future plans, recruiter contacts, awareness of military advertising and enlistment incentives, and the interrelationships among these variables. Further, researchers would be able to estimate the proportion of category I-IIIA youths in the surveyed population as a whole or in subgroups of special interest.

There are two methods that would enable such analyses to be conducted. First, AFQT scores could be measured directly as part of the survey. This has been done in some instances as, for example, in the 1980 wave of the National Longitudinal Survey of Youth Labor Market Experience (NLS). The problem with this method is that it is costly and time consuming. It requires respondents to answer so many additional questions that the extra time required to obtain their AFQT scores may exceed the time required to complete the original survey. This problem is especially serious in nonlongitudinal surveys. In

longitudinal surveys such as the NLS, the same respondents are interviewed in each survey wave. In such instances, it may suffice to measure AFQT scores in one wave. However, many surveys are either one-time surveys or are repeated but administered to different respondents in each wave. For such surveys, respondents' AFQT scores need to be measured in every survey administration. As a result, the additional financial cost and added burden on respondents are likely to be unacceptable.

The second approach is the one we have adopted. AFQT categories can be estimated using information routinely collected in the survey. This approach has two advantages. First, because it is not necessary to add many items to the survey instrument, the cost of data collection and the burden placed on respondents are not increased. Second, the estimation procedure does not have to be repeated for each new wave or survey. Once the AFQT equations have been estimated, they can be used with any survey of the national youth population that includes the appropriate respondent background information. Thus, while this report describes the development and application of a quality-based analysis capability for certain waves of the Youth Attitude Tracking Study (YATS), it should be kept in mind that use of the estimation procedure is not restricted to these waves or to the YATS Survey.

THE YOUTH ATTITUDE TRACKING STUDY

The Youth Attitude Tracking Study is the primary recruiting-related survey sponsored by the Department of Defense on an ongoing basis. The YATS is a large-scale survey of the "military available" population—youths who have never served in the military and have completed two years or less of college. Its purpose is two-fold: to indicate trends in attitudes toward the military and to provide information that can be used to guide military advertising and recruiting efforts. The YATS was initiated in 1975 as a semi-annual survey of male youth 16–21 years of age. In 1980, it was changed to an annual survey and expanded to include women. The survey assesses demographic information, work and academic experience, knowledge about military programs and advertising, recruiter contacts, and intentions to enlist in the military.

During recent years, the services have become more interested in recruiting high quality youths. Thus, to help guide recruiting and advertising efforts, it has become more important to provide separate YATS data summaries for higher versus lower quality respondents. However, because actual AFQT information is not collected as part of the YATS survey, it has not been possible to provide such summaries.

As a substitute for AFQT category information, the practice was to construct a "quality index" score, based on a respondent's self-reported grade-point average and coursework in high school. Respondents were customarily divided into high, medium, and low quality index score groups, and results were reported separately for the three groups. In 1983, the quality index was abandoned, and the respondent groups were separated based on the self-reported grade-point average alone.

Although it was reasonable to suppose that the aptitude—i.e., AFQT scores—of youths reporting high grade-point averages (or completing many math courses) was higher than that of other youths, it was not possible to confirm such relationships solely from the information available in the YATS. Since the grade-point average and coursework information was self-reported, the validity and usefulness of these results were suspect. Moreover, nothing was known about the relative importance of the different variables used to construct the quality index in predicting actual AFQT results or, in particular, about the appropriateness of the weighting scheme used to construct the quality index score.

PRIOR YATS RESEARCH

Over the past few years, RAND has investigated the relationship between the enlistment intentions respondents express in the YATS and their actual subsequent enlistment decisions. As part of that work, the YATS results have been matched with extracts of information from the Military Enlistment Processing Command's database of enlistment and written examination records. That database contains a crucial piece of information from the standpoint of assessing aptitude: the actual AFQT scores obtained by persons testing to qualify for military service. Thus, the matched YATS-enlistment records provide AFQT scores for the subset of YATS respondents who take the qualifying written test, approximately 20 percent of the young men's YATS sample. As work has progressed on assessing the relationship between intentions and enlistment, the information on AFQT scores has been used to develop a method of analyzing YATS results separately for higher and lower quality youths.

Early work in this effort produced several important findings (see Orvis, 1984; and Orvis and Gahart, 1985). For example, the validity of the self-reported data was supported. It was found that self-reported grade-point average and coursework information in the YATS was significantly related to respondents' actual AFQT scores. On the other hand, the specific algorithm used to compute the quality index score

was called into question. It was discovered that the quality index systematically underpredicted the AFQT scores of young respondents relative to older ones, because they had not had sufficient opportunity to take the math courses used to construct the quality index score. Moreover, the research indicated that in addition to coursework and grade-point average, there were other variables in the YATS that should be used to predict AFQT score.

Subsequently, models of AFQT score were constructed using the information comprising the quality index and these additional variables. The results produced by the early models were encouraging. However, the models were not fully satisfactory. The potential difficulty with the early models arose from the limited availability of AFQT score information for YATS respondents. As noted, only about 20 percent of the respondents take the written test to qualify for military service. Persons who take the written test differ in systematic ways from the general youth population. Such differences should be modeled and controlled statistically to ensure that satisfactory results are obtained for the population of interest; that is, to adjust the coefficients in the test-takers' AFQT equation as required to provide unbiased coefficients for the population as a whole. This can be accomplished by developing a two-equation model that estimates the likelihood an individual will take the written test, the probability that he will score in categories I-IIIA if he does so, and the association of the error terms in the two equations.

It should again be emphasized that the resulting AFQT estimation equations are applicable not only to the YATS, but to any comparable study of the national youth population providing information on the relevant variables. Thus, the procedure provides a means of analyzing national youth survey results by aptitude level without undertaking the costly and time-consuming process of measuring AFQT scores directly.

PLAN OF THE REPORT

Section II discusses the development of the AFQT category prediction models and presents the equations. In Sec. III, we examine the accuracy and reliability of the results. Section IV provides a detailed illustration of one use of the models: it examines results for the various category I-IIIA subgroups and compares them with those for the corresponding category IIIB-V subgroups, using selected measures from the 1985 YATS survey. In Sec. V, we summarize our work and discuss additional potential applications.

II. ESTIMATION OF AFQT SCORE

OVERVIEW

This section describes the development and application of a two-equation maximum likelihood technique to estimate the AFQT categories of nonprior service youths. Our procedures estimate the probability that a male YATS respondent 16–21 years of age would achieve an AFQT score at or above the 50th percentile (i.e., categories I-IIIA) if he were to take the written test to qualify for military service, based on the 1980 metric for converting raw AFQT scores to percentile scores.[1] First, we discuss the rationale and structure of the approach. Next, we describe the database used for the estimation of the equations. Then, the simultaneous two-equation maximum likelihood estimation procedure is reviewed. The review includes a discussion of the technique, the variables entered into the models, and the resulting equations. An example of the application of the equations is also provided.

RATIONALE

Our approach was shaped by military recruiting policy and the characteristics of the YATS database. First, as noted earlier, the services are especially interested in recruiting AFQT category I-IIIA youths, as compared to category IIIB-V youths. Thus, the models we developed estimate the probability that an individual would score at or above the 50th percentile on the AFQT if he took the test. However, the estimation technique is applicable to any alternative dichotomous categorization of AFQT scores or, with certain adjustments, to the estimation of AFQT percentile scores.

Second, many YATS respondents who test do so long after their participation in the YATS survey. Since we are interested in predicting the AFQT score an individual would obtain under normal circumstances—that is, at the point when the average individual with his characteristics tests to qualify for military service—the analysis was

[1]AFQT scores are a composite of several subtests of the Armed Services Vocational Aptitude Battery (ASVAB). The algorithm for transforming raw subtest scores into AFQT percentiles was changed in 1980, to correct a miscalibration that had artificially inflated the percentile scores of some earlier test-takers (see Berryman, Bell, and Lisowski, 1983). The calibration procedure adopted in 1980 is followed throughout this report.

not restricted to persons who tested during a brief interval after the survey date or by a certain age. Instead, we constructed a dataset that allowed for a substantial post-interview follow-up period: at least four and one-half years. This allowed us to capture virtually all AFQT tests ever taken by the respondents. It is important to keep in mind that the variables entered into the equations indicate status at interview, not status at testing. Given the long time elapsing between the interview and testing dates for many respondents, the coefficients of the variables may differ from those obtained in studies where AFQT scores are measured at the survey point or shortly thereafter.

Third, the YATS includes individuals with a wide range of abilities, experiences, and plans. Importantly, the YATS includes both high school students and individuals no longer in high school. Past research concerning the enlistment decisions of young men has found that high school students and persons no longer in high school differ in fundamental ways (see, for example, Hosek and Peterson, 1985; Orvis and Gahart, 1985). In particular, high school students are approaching a natural decision point involving a choice between higher education, civilian employment, and military service. In contrast, individuals no longer in high school have passed this point of decision; their continued eligibility for the YATS sample means that they did not enter military service after high school. Most have acquired experience in the civilian labor force or pursued higher education. Because of these differences, separate analyses were conducted for high school students and for persons no longer in high school.

Finally, as noted earlier, only about 20 percent of young male YATS respondents take the AFQT, and, moreover, those who do test are not a representative sample of the national youth population (see Orvis and Gahart, 1985). In general, the aptitude of individuals who choose to take the AFQT is somewhat lower than the aptitude of those who do not test.[2] One manifestation of this aptitude discrepancy is that many factors that are positively associated with test-taking are negatively related to scoring in categories I-IIIA. For example, among high school students, the likelihood of testing decreases as self-reported grade-point average increases, but a high grade-point average increases the probability of scoring in categories I-IIIA among those who do test. Similarly, persons attending college at the time of interview are less likely

[2]This statement does not conflict with evidence that the aptitude level of recent enlistees is equal to, or somewhat greater than, the aptitude level of the general population of young men (e.g., Congressional Budget Office, 1986; OASD(MRA&L), 1982; Toomepuu, 1986). This is because many low aptitude test-takers are screened out during the enlistment process. Indeed, persons with AFQT scores below the 10th percentile are prohibited from enlisting by law. In contrast, most high aptitude young men are eligible to enlist if they choose to do so.

to take the AFQT than other persons out of high school, but they are more likely to receive a high score if they do test.

The nonrepresentativeness of AFQT-takers is the major factor underlying our choice of statistical approaches. It means that models developed to predict AFQT results which rely on simple, single-equation regression techniques applied to a dataset of test-takers may produce biased coefficients for the population as a whole. To deal with this potential problem, we employed a two-equation procedure that explicitly accounts for an individual's probability of taking the written test (see Heckman, 1976, for a helpful discussion of the issues associated with the analysis of nonrandomly selected datasets).

DATABASE

The primary database used in our analyses consists of the results provided by respondents to the fall YATS survey waves administered in 1976–1980. Although the YATS was conducted twice yearly during this period, respondents to the spring survey waves were excluded for two reasons: (1) the YATS now is fielded exclusively in the autumn, and (2) the characteristics of respondents to spring and fall YATS administrations differ in systematic ways. Fall interviews coincide with the start of the academic year, whereas spring surveys occur late in the academic year. Thus, for example, the age distribution in the spring waves differs from that in the fall waves; this would be the case even if the same individuals surveyed in the fall were resurveyed in the spring. Such differences affect the parameter estimates obtained in the AFQT estimation procedure. Since we wish to apply the equations to future YATS survey data—which will be obtained in fall administrations—we based development of the equations on results from fall YATS waves.[3]

Military Entrance Processing Station (MEPS) Reporting System (MRS) records were merged with the YATS data in order to add AFQT information to the analysis file for those respondents who had taken the written test. MRS information was available through March 1985; thus, the follow-up period extended at least four and one-half years after the survey date.

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[3]The timing of survey administration need not affect the use of the AFQT estimation procedure, as true, for example, when age in the fall can be determined from the particular age question(s) included in the survey. Even when this is not possible—as in the YATS—the results reported in the next section suggest that the method provides useful results for surveys administered during other time periods.

ESTIMATION PROCEDURE

General Approach

While scoring at or above the 50th percentile on the AFQT is a dichotomous variable with two **discrete** categories (individuals either score at or above the 50th percentile or they do not), every test-taker has some probability greater than zero of scoring at or above the 50th percentile. Because some individuals have a very small chance of scoring in categories I-IIIA and others are extremely likely to do so, the estimation procedure generates a **continuous** probability score for each respondent. **Thus, instead of identifying each respondent discretely as either a high or low aptitude individual, the estimation procedure provides an estimate of the probability an individual would score at or above the 50th percentile if he took the AFQT.** In generating data summaries for high aptitude youths, the survey results provided by each individual will be weighted **proportionally to his estimated probability of scoring at or above the 50th percentile on the AFQT.**

A simultaneous two-equation probit model is used to generate two sets of coefficients (see Maddala, 1983, p. 98). The first set of coefficients, associated with the probability of testing, is estimated with data from the entire YATS sample. The second set of coefficients, associated with the probability of scoring at or above the 50th percentile, of necessity is estimated only with data from AFQT-takers. The model accounts for the fact that AFQT examinees are not a representative sample of the national youth population (nor, thus, of YATS respondents) by adjusting the second set of coefficients to minimize the selectivity bias that is measured and modeled by the first set of coefficients. Taken by itself, the second set of coefficients can be applied to a "non-selected" sample—in this case, the representative sample of the military eligible youth population captured by YATS—to generate unbiased estimates of the probability of scoring at or above the 50th percentile on the AFQT.

Estimation of Equations and Probabilities

The two-equation probit model provides the following parameter estimates: a vector of coefficients for the variables that predict taking the AFQT; a vector of coefficients for the variables that predict scoring in categories I-IIIA; and an estimate of the correlation between the error terms in the two equations. The correlation between the error terms represents the extent to which unmeasured factors exert a

common influence on the probability of testing and the likelihood of scoring in categories I-IIIA. The parameter values are generated using a maximum likelihood estimation procedure. The equations may be expressed as:

$$F^{-1}(Y_1) = \alpha_1 + \beta_1 X_1 + \epsilon_1 \text{ and} \quad (1)$$

$$F^{-1}(Y_2) = \alpha_2 + \beta_2 X_2 + \epsilon_2 \quad (2)$$

where F^{-1} = probit function (i.e., inverse cumulative standard normal distribution function),

Y_1 = tested (0 = no, 1 = yes),

Y_2 = obtained AFQT score of 50 or higher (0 = no, 1 = yes), estimated only if $Y_1 = 1$,

$\beta_1 X_1$ and $\beta_2 X_2$ are vectors of variables and coefficients,

α_1 and α_2 are constants, and

ϵ_1 and ϵ_2 are error terms.

Different procedures are applied to the parameter values to compute estimates of the probability of scoring in categories I-IIIA for selected samples (e.g., test-takers) versus nonselected samples (e.g., samples of the general youth population). For **test-taker samples** (i.e., selected samples), the **conditional** probability of scoring in AFQT categories I-IIIA is computed by using both vectors of coefficients and the correlation between the error terms. The predicted outcome values generated by the vectors of coefficients and the estimated correlation between the error terms in the two equations are entered into the cumulative standard normal distribution and cumulative bivariate standard normal distribution functions to estimate the probability of three mutually exclusive outcomes for each respondent: the probability of not testing (P_1), the probability of testing and receiving a score below the 50th percentile (P_2), and the probability of testing and receiving a score at or above the 50th percentile (P_3). The sum of the probabilities is one. The three probabilities may be expressed as follows:

$$P_1 = F_1(-(\alpha_1 + \beta_1 X_1))$$

$$P_2 = F_2(\alpha_1 + \beta_1 X_1, -(\alpha_2 + \beta_2 X_2), -\rho)$$

$$P_3 = F_2 (\alpha_1 + \beta_1 X_1 , \alpha_2 + \beta_2 X_2 , \rho)$$

where F_1 = cumulative standard normal distribution function,

F_2 = cumulative bivariate standard normal distribution function, and

ρ = correlation of ϵ_1 and ϵ_2 from Eqs. (1) and (2) above.

The conditional probability that an individual will score at or above the 50th percentile if he tests is the probability of testing and receiving a high aptitude score divided by the probability of testing. This may be calculated as:

Conditional probability of scoring at or above the 50th percentile on the AFQT = $P_3 / (P_2 + P_3)$ or,

alternatively, $P_3 / (1 - P_1)$.

For individuals drawn from the **population as a whole** (i.e., for nonselected samples), the procedure is simpler and relies only on the second (high AFQT) equation. In this case, an individual's (unconditional) probability of scoring in AFQT categories I-IIIA is the cumulative standard normal function value of the estimate generated by the second set of coefficients:

$$P = F_1(\alpha_2 + \beta_2 X_2)$$

To reiterate, applications of this technique to provide aptitude-based data summaries for youths in the general population should use the second, simpler procedure involving only the coefficients from the high AFQT equation and the cumulative standard normal distribution function.

Variables

The independent variables selected for entry into the probit models meet two criteria. First, they are central and enduring components of the YATS survey. That is, not only were they included in the five administrations of the YATS that compose the analysis dataset, but they also were contained in each version of the YATS from 1981 through 1985, and they are unlikely to be deleted in future YATS administrations. Second, prior research indicates that the entered variables are likely to be correlated with the probability of taking the

AFQT, the likelihood of receiving an AFQT score at or above the 50th percentile, or both.

Completing the AFQT is a necessary step in the enlistment process. Thus, prior work on the enlistment decisions of young men helped identify variables related to test-taking (e.g., Hosek and Peterson, 1985; Orvis and Gahart, 1985). This work views enlistment in the context of a broader decision involving a choice among military service, higher education, and civilian employment, which are generally viewed as competing alternatives.[4] Thus, persons actively pursuing higher education or those with stable civilian jobs are predicted to be less likely to enlist. Conversely, persons not attending school or having difficulty in the civilian labor market are predicted to be more likely to enlist.

Similarly, prior research concerning the relationship between individual characteristics and AFQT score provided guidance in selecting variables to predict scoring in categories I-IIIA (OASD(MRA&L)), 1982; Orvis, 1984; Kyle Johnson, DMDC, personal communication concerning AFQT score differences among NLS respondents). Not surprisingly, measures of mental aptitude—such as indices of academic performance—are positively correlated with AFQT score, as are background characteristics related to socioeconomic status, such as parents' education.

On the basis of earlier research and exploratory analyses, four sets of predictor variables were used in the two equations. They represent background characteristics, economic factors, educational experience, and military interest indicators. The variables in the test and AFQT equations are discussed below. The particular variables selected for the high school student equations differ somewhat from those selected for respondents no longer in high school. As noted, the variables entered into the equations indicate status at interview, not status at testing.

Test equation. *Background characteristics:* Race, age, and geographical region variables were included in the test equations. Prior research shows that blacks and other minorities enlist more frequently than white non-Hispanics, that the probability of enlistment decreases with age for individuals no longer in high school, and that persons residing in the South are more likely to enlist.

Economic factors: As might be expected, exploratory analyses indicated that current employment status variables are less meaningful predictors of testing among high school students than among persons no longer in high school. Based on these analyses, current employment

[4]The exception to this pattern occurs among nonstudent high school graduates. Among such persons, expectations for continued education are positively related to enlistment (Hosek and Peterson, 1985). This relationship could not be modeled in the YATS, since educational expectations were not assessed.

status variables were not included in the equations for high school students. However, prior research has shown that high school students who believe it is easy to find full-time employment in their community are less likely to enlist than others (Orvis and Gahart, 1985); therefore, this variable was represented in the test equation. For individuals not in high school, labor market participation factors are more important, and their meaning should depend on one's educational status. For example, persons looking for work may be expected to be more likely to test than those holding jobs. And, being out of the labor force (i.e., not employed and not looking for work) may have different implications for persons depending on whether or not they are in college. Because of the importance of employment and education factors, the equation for persons not in high school included a complete set of employment variables crossed by college attendance status. The perceived ease of finding full-time employment was also assessed.

Educational experience: Variables measuring high school grade-point average, mathematics courses completed, and year in school were entered in the test equation for high school students. Since academically successful high school students may be expected to be more likely than others to attend college or find employment in the civilian labor market, all of these variables should be negatively related to the probability of testing. For individuals not in high school, measures of college attendance and high school graduation status were included for similar reasons.

Military interest: Variables measuring the respondent's intention toward enlisting in the military, prior recruiter contacts, and conversations with his parents about enlisting were included in the test equations. Individuals with a stated intention to enter military service, who have discussed enlisting with their parents, or who have had contact with a military recruiter are known to enlist more frequently than others (Orvis and Gahart, 1985).

High AFQT equation. *Background characteristics.* Race, region, and age variables were included in the high AFQT equation, along with father's education. As documented elsewhere (e.g., OASD(MRA&L), 1982), blacks and other minorities score lower than white non-Hispanics, and persons residing in the South score more poorly than others. AFQT scores increase slightly with age at testing. Also, children of well-educated parents obtain higher AFQT scores than children of less educated parents.

Economic factors. Among persons no longer in high school, individuals not attending college were distinguished according to whether they held full-time jobs, part-time jobs, or were unemployed, because employability should be related to higher aptitude. The full-time

employment variable was crossed by college attendance status. The YATS survey did not provide information on the level of college attendance (e.g., class hours), only on whether the respondent was taking some college classes at the survey point. Holding a full-time job while attending college is relatively uncommon (less than 20 percent of the test-takers in our sample attending college also had full-time jobs). Such persons may be taking a lighter college course load than other attendees and also may differ in aptitude from other college students.

Educational experience. Earlier research has shown that individuals who do well in school also perform well on the AFQT. Thus, high school grade-point average and mathematics courses completed were included in the high AFQT equation. In addition, a senior year term was included for high school students; those who persevere to the senior year generally have higher aptitude than those who drop out of high school. For persons not in high school, variables indicating high school graduation status and college attendance were included for similar reasons.

Military interest. Previous research has indicated that stated intentions to enlist provide important information about an individual's probability of enlisting that is not fully captured by his observed characteristics (Orvis and Gahart, 1985). Since individuals who test tend to have lower aptitude than those who do not, we may expect persons who intend to enlist to have lower aptitude than those who say they are unlikely to do so. Given this relationship, to the extent that intentions summarize information about an individual that is not captured by other observed characteristics, they may be expected to be important in explaining his AFQT score. Exploratory analyses confirmed that intentions had a significant effect on AFQT score, even after controlling for other factors. Moreover, they indicated that the inclusion of intentions in the AFQT equation was crucial to obtaining reasonable AFQT score estimates for the population as a whole. As a result, a variable representing stated enlistment propensity was included in the AFQT equation.

A complete description of the variables, their sources, and coding can be found in the Appendix.

Parameter Estimates

The parameter estimates for high school students are listed in Table 1. The coeff.ients for the testing equation are generally consistent with the results of previous research. The background and economic factor coefficients indicate that blacks are more likely to test than white non-Hispanics, as expected. There was no effect of residing in the South after controlling for the other variables in the equation

Table 1

PARAMETER ESTIMATES FOR RESPONDENTS IN HIGH SCHOOL

Factor	Parameter Estimate	*t*-statistic[a]
I. TEST EQUATION ($\alpha_1 + \beta_1 X_1$)		
Intercept	− .5055	− 5.37
Background characteristics		
Race (vs. white, non-Hispanic)		
Black	.3739	8.05
Other nonwhite	− .0311	− 0.45
Resides in the South	− .0158	− 0.46
Economic factors		
Perceived ease of finding full-time employment[b]	− .0493	− 2.28
Educational experience		
Senior (vs. sophomore or junior)	− .0685	− 2.00
Grade-point average[c]	− .1312	− 5.02
Courses completed in high school		
Elementary algebra	− .0367	− 1.02
Geometry	− .0797	− 2.14
Intermediate algebra	− .1437	− 3.84
Trigonometry	− .1797	− 3.61
Military interest		
Intention to enlist (vs. negative)[d]		
Very positive	1.0250	17.27
Somewhat positive	.3999	10.98
Had recruiter contact	.1772	5.28
Talked to parents about enlisting	.3478	9.85
II. HIGH AFQT EQUATION ($\alpha_2 + \beta_2 X_2$)		
Intercept	−1.7071	− 6.75
Background characteristics		
Race (vs. white, non-Hispanic)		
Black	−1.0335	− 9.96
Other nonwhite	− .4373	− 3.20
Age 16 or 17 (vs. 18)	.5469	5.12
Resides in the South	− .2241	− 3.37
Father's education[e]	.0904	2.80

Table 1—continued

Factor	Parameter Estimate	*t*-statistic[a]
Educational experience		
Senior (vs. sophomore or junior)	.2274	3.24
Grade-point average[c]	.2085	3.91
Courses completed in high school		
Elementary algebra	.3065	4.41
Geometry	.5592	7.86
Intermediate algebra	.2805	3.78
Trigonometry	.3329	3.01
Military interest		
Intends to enlist (vs. negative)	− .2569	− 2.51
III. RHO	.0378	0.33

[a]*t*-statistics with an absolute value of 1.96 or greater indicate that the corresponding parameter estimate differs significantly from zero (at the $p < .05$ level). N = 8426 for test equation; N = 2041 for AFQT equation.

[b]Uses 4-point scale: 1 = almost impossible; 4 = not difficult at all.

[c]Uses 3-point scale: 2 = mostly C's and below; 4 = mostly A's and B's.

[d]Very positive intention = says definitely or probably will be serving in the military in the next few years and has unaided mention of plans to join the military; somewhat positive intention = says definitely or probably will be serving in the military but made no unaided mention; negative intention = says will probably not or definitely not be serving in the military, or is unsure whether will be serving.

[e]Uses 4-point scale: 1 = not high school graduate; 2 = high school graduate; 3 = some college; 4 = college graduate.

(including stated enlistment intentions). Individuals who believe it is easy to find a full-time job are less likely to test than those believing it is difficult. As expected, scholastic success—measured by grade-point average, mathematics courses completed, and perseverance to the senior year—is negatively related to the probability of testing. Finally, there is a strong positive relationship between interest in the military—as reflected by positive enlistment intentions, discussing enlisting with one's parents, or prior contact with a recruiter—and the likelihood of testing.

The parameter estimates in the high AFQT equation also are consistent with earlier work and observed patterns. White non-Hispanics are more likely than other racial groups to score at or above the 50th percentile, as are residents of geographical regions outside the South. As expected, father's education—a measure of socioeconomic status—also is positively associated with scoring well. Not surprisingly, measures of academic success predict scoring at or above the 50th

percentile. Grade-point average, mathematics courses completed, and reaching the senior year in school—again, a measure of the successful completion of previous grades—are positively related to scoring well. The positive effect for younger respondents (ages 16 or 17 years) reflects the fact that underclassmen have had less chance to complete the math courses included in the equation than have seniors. Some younger students receive zero values for the mathematics course variables even though they will complete the courses before leaving high school. The age variable cannot tell us who these persons are; however, the coefficient provides an average adjustment for all younger students. With respect to military interest, the significant effect for the enlistment intention variable indicates that persons with positive intentions score significantly lower on the AFQT than those who do not intend to enlist, after controlling for the other factors in the model. Finally, the estimated correlation between the error terms in the testing and AFQT equations is near zero and not statistically significant.

The parameter estimates for respondents not in high school are listed in Table 2. The results are consistent with previous work. As expected, we found that blacks and other nonwhites (including Hispanics) test more frequently than white non-Hispanics, and that younger persons test more frequently than older ones. There is no effect for residing in the South, after controlling for the other variables in the test equation. With respect to economic and educational factors, among persons not in college, those looking for work are more likely to test than those employed full-time. Those working part-time or out of the labor force also are more likely to test than those working full-time, but not significantly so. Among college students, the likelihood of testing also varies with employment status. Overall, persons attending college are significantly less likely to test than full-time employees not in college. However, college students who also are working full-time or looking for work are not less likely to test. Such persons probably are less able to afford to continue their higher education than other college students, and, thus, are more likely to enlist. Conversely, college students not in the labor force are especially unlikely to take the written test to enter military service. Persons believing it is easy to find a full-time job are marginally less likely to take the written test, whereas high school dropouts are significantly more likely to test. Finally, all measures of interest in the military are positively related to testing. Persons expressing positive enlistment intentions, who had prior contact with a recruiter, or who discussed enlisting with their parents are more likely to test.

As seen in the lower portion of Table 2, the AFQT equation for individuals not in high school generally confirms our expectations. With

Table 2

PARAMETER ESTIMATES FOR RESPONDENTS NOT IN HIGH SCHOOL

Factor	Parameter Estimate	*t*-statistic[a]
I. TEST EQUATION ($\alpha_1 + \beta_1 X_1$)		
Intercept	−1.4095	−19.17
Background characteristics		
Race (vs. white, non-Hispanic)		
Black	.3987	7.81
Other nonwhite	.2032	2.74
Age (vs. 16–18)		
Age 19	− .0920	− 2.11
Age 20	− .1380	− 2.83
Age 21	− .1880	− 3.46
Resides in the South	− .0461	− 1.28
Economic factors		
Current job status (vs. employed full-time and not attending college)		
Employed part-time, not attending college	.0910	1.38
Looking for work, not attending college	.2381	4.67
Out of labor force, not attending college	.1164	1.19
Employed full-time, attending college	.0373	0.40
Employed part-time, attending college	− .1098	− 1.85
Looking for work, attending college	.0742	0.81
Out of labor force, attending college	− .3669	− 4.21
Perceived ease of finding full-time employment[b]	− .0339	− 1.82
Educational experience		
High school dropout[c]	.1328	2.97
Military interest		
Intention to enlist (vs. negative)[d]		
Very positive	.7395	8.21
Somewhat positive	.2746	6.24
Had recruiter contact	.3764	10.09
Talked to parents about enlisting	.4122	11.08
II. HIGH AFQT EQUATION ($\alpha_2 + \beta_2 X_2$)		
Intercept	−1.2285	− 3.76
Background characteristics		
Race (vs. white, non-Hispanic)		
Black	−1.1873	− 9.29
Other nonwhite	− .7999	− 5.28
Resides in the South	− .0907	− 1.09
Father's education[e]	.1280	3.18

Table 2—continued

Factor	Parameter Estimate	t-statistic[a]
Economic factors		
Employed full-time, not attending college	− .0616	− 0.59
Employed part-time, not attending college	.0850	0.52
Educational experience		
Current status (vs. high school graduate not attending college)		
Attending college	.3527	2.47
Attending college, employed full-time	− .4904	− 2.16
High school dropout	− .3630	− 3.65
High school grade-point average[f]	.2817	4.10
Courses completed in high school		
Elementary algebra	.2948	3.27
Geometry	.2750	3.01
Intermediate algebra	.1595	1.74
Trigonometry	.2961	2.59
Military interest		
Intends to enlist (vs. negative)	− .3472	− 3.29
III. RHO	− .0378	− 0.32

[a] t-statistics with an absolute value of 1.96 or greater indicate that the corresponding parameter estimate differs significantly from zero (at the $p < .05$ level). N = 8907 for test equation; N = 1434 for AFQT equation.

[b] Uses 4-point scale: 1 = almost impossible; 4 = not difficult at all.

[c] Did not graduate from high school.

[d] Very positive intention = says definitely or probably will be serving in the military in the next few years and has unaided mention of plans to join the military; somewhat positive intention = says definitely or probably will be serving in the military but has made no unaided mention; negative intention = says will probably not or definitely not be serving in the military, or is unsure whether will be serving.

[e] Uses 4-point scale: 1 = not high school graduate; 2 = high school graduate; 3 = some college; 4 = college graduate.

[f] Uses 3-point scale: 2 = mostly C's and below; 4 = mostly A's and B's.

respect to background characteristics, the probability of scoring at or above the 50th percentile is lower for blacks and other racial minorities, in comparison with white non-Hispanics. Residing in the South is not a significant factor in explaining AFQT score, after controlling for the other variables in the equation. The likelihood of scoring well does increase with higher levels of father's education. The coefficients for educational factors indicate that high school grade-point average and mathematics courses completed are positively associated with scoring

well on the AFQT. In comparison with high school graduates not attending college, nongraduates are less likely to score at or above the 50th percentile, whereas graduates attending college are more likely to do so. The effect of college attendance is negligible among persons taking college classes and working full-time, however. As noted earlier, such persons may represent a special subpopulation of college attendees who are pursuing less intensive studies. Our expectation that, among persons not in college, full-time or part-time employees might score higher than others was not supported. Finally, persons expressing intentions to enlist scored lower on the AFQT than those not intending to do so. As true for high school students, the correlation between the error terms for the two equations was not significant.

Enlistment Intentions and Selectivity

As noted above, the estimated correlation between the error terms in the testing and AFQT equations is small, both for the high school student sample and for those no longer in high school. This indicates that, given the final specifications of these models, selectivity is not a major problem: equivalent sets of coefficients would have been derived by applying single-equation regression methods to the test-taker datasets. This result requires the inclusion of enlistment intentions in the high AFQT equation. The conceptual basis for including intentions in the AFQT equation was discussed above. We next comment on two analytic issues.

One issue concerns the effect of possible changes in the distribution of enlistment intentions on the usefulness of the AFQT estimates. Since the inception of the YATS more than 10 years ago, changes in the overall positive intention level have been very small, rarely exceeding a few percentage points. Moreover, the other variables in the AFQT equation provide some control for the possible effects of such shifts on the (true) coefficient for the intention variable. For these reasons, it is very unlikely that the types of changes in the distribution of enlistment intentions that might be experienced over the near term will affect the usefulness of the AFQT equation to an appreciable extent. This is especially true given the primary intended use of the probability estimate derived in the second equation, which, as discussed earlier, is to weight youth survey results to provide separate data summaries for higher versus lower quality youths. A shift of several percentage points in the positive intention level has very little impact on such comparisons.

The second analytic issue—the endogeneity (or lack of independence) of intentions with other factors in the AFQT equation—is

related to the first, and should be viewed in the same context. Because endogeneity exists, the coefficients for other factors must be interpreted based on the inclusion of intentions in the AFQT equation. Given the purpose of the research, this limitation is acceptable.

Application of Equations

As discussed earlier, the application of the model differs depending on whether the equations are applied to a selected or nonselected sample. For samples of individuals known to have taken the test (i.e., selected samples), both equations and the correlation between their error terms are used in conjunction with the cumulative standard normal and cumulative bivariate standard normal distribution functions to generate the conditional probability of scoring at or above the 50th percentile given testing. We anticipate, however, that most uses of the methods described in this report will apply to the population as a whole; that is, samples that are drawn with no knowledge of the testing status of potential respondents. **For samples of the population as a whole (i.e., nonselected samples), the high AFQT (second) equation is used alone. The result is entered into the cumulative standard normal distribution function to predict the probability of scoring in AFQT categories I-IIIA.** To generate data summaries for high aptitude individuals, the survey results provided by each respondent are weighted proportionally by this probability.

To illustrate the application of the equations for a respondent from a nonselected sample, we will estimate the probability of achieving an AFQT score at or above the 50th percentile for a fictitious high school student. Consider a student with the following characteristics: white, non-Hispanic; age 18; lives in the South; father is a high school graduate (a score of 2 on the 4-point scale); is a senior; has received mostly B's and C's in high school (a score of 3 on the 4-point scale); has completed elementary algebra and geometry; and has a positive intention to enlist.

By combining the individual's characteristics with the coefficients presented in Table 1, we derive values for $\alpha_2 + \beta_2 X_2$.

$\alpha_2 + \beta_2 X_2$ (high AFQT equation) = Intercept (−1.7071) +
Black (0) +
Other nonwhite (0) +
Age 16–17 (0) +
South (−.2241) +
Father's education
(2 × .0904 = .1808) +

Senior (.2274) +
Grade-point average
(3 × .2085 = .6255) +
Elementary algebra (.3065) +
Geometry (.5592) +
Intermediate algebra (0) +
Trigonometry (0) +
Intends to enlist (−.2569)
= **−.2887**

The individual's probability of scoring at or above the 50th percentile is simply the cumulative standard normal distribution function value of z = −.2887. This is .3864. Thus, our hypothetical respondent has about a 39 percent chance of scoring in AFQT categories I-IIIA.

AFQT ESTIMATION FOR WOMEN

This report focuses on the development of a quality-based analysis capability for male youth, using the major enlistment-related survey of the nonprior service military available population sponsored by the Department of Defense on an ongoing basis, the Youth Attitude Tracking Study. Women were not included in the YATS until fall 1980. Moreover, after 1981, the size of the female sample was reduced dramatically. Given the limited number of female YATS respondents, the shortness of the follow-up period possible for them, and the generally low AFQT testing rate among women—about 5 percent—it proved difficult to estimate meaningful equations for females.

We began with the variables included in the models developed for male youth, and attempted to generate new parameter estimates for women. However, the number of cases proved too small to permit estimation of the two-equation model. Given these results and the near-zero error term correlations obtained in the men's models, we chose simply to estimate high AFQT score probit equations for women. The resulting equations provide a reasonable fit to the actual results obtained for female YATS AFQT-takers. Many of the variables with significant coefficients for men are not significant for women, however. We conducted a number of analyses using different variables to address this finding. The results were similar in every case. Because of the small number of female AFQT-takers, the coefficients for many variables fail to reach statistical significance; without these conceptually important variables, however, the accuracy of the model is unacceptable. In the end, we concluded that, given the limitations of the data,

the most reasonable course of action is to rely on the AFQT models developed for the male respondents. The parameter estimates for women in these models, as well as information on the accuracy of the equations for women, are found in the Appendix.

III. ACCURACY AND RELIABILITY OF ESTIMATION PROCEDURE

To assess the accuracy and reliability of the estimation technique, we conducted two types of analyses. Both involve comparisons of predicted AFQT results with the actual results of persons who tested. One analysis compares the predicted probability that AFQT-takers will score at or above the 50th percentile with the proportion of individuals actually scoring in categories I-IIIA. In this type of analysis, the estimation procedure should meet two criteria: first, it should be capable of generating a full range of predicted probabilities, that is, the predictions should be distributed fully between 0 and 1, rather than clustered narrowly around the mean probability; second, the predicted and actual probabilities should correspond closely across the full range of actual results.

The second type of analysis compares the predicted characteristics of high aptitude test-takers with their actual characteristics. Because of their importance in recruiting efforts, the predicted distributions of background characteristics, educational and employment experiences, and military interest indicators should mirror the actual distributions. We had some concern that this might not be so, since measures of these characteristics are prominent variables in the testing and AFQT equations. Thus, it was possible that the predicted distributions for these variables might be biased in the direction of the parameter estimates, especially for variables with large coefficients. This would be a potentially serious problem, since the construction of profiles for category I-IIIA youths constitutes an important application of the estimation procedure.

Each type of analysis was made for two datasets. To assess the accuracy of the estimation method, we analyzed the database used to develop the equations. As discussed earlier, it contained information provided by YATS respondents in the fall 1976–1980 waves. To assess the reliability of the method, we analyzed results from a second database containing information provided by respondents to the spring 1976–1980 YATS surveys, including matching AFQT information for the respondents who tested.

Table 3 compares the predicted probability that AFQT-takers will score in categories I-IIIA with the actual proportion scoring in categories I-IIIA in the fall 1976–1980 dataset. The table presents results separately for high school students and for respondents no

Table 3

COMPARISON OF PREDICTED AND ACTUAL AFQT RESULTS FOR TEST-TAKERS IN FALL 1976–1980 YATS WAVES

Predicted Probability of Scoring in Categories I-IIIA	Actual Proportion Scoring in Categories I-IIIA		(Number)	
	High School Students	Respondents Not in High School	High School Students	Respondents Not in High School
$.90 < p \leq 1.00$	.93	.92	(82)	(49)
$.80 < p \leq .90$	.82	.84	(149)	(116)
$.70 < p \leq .80$	.76	.73	(190)	(113)
$.60 < p \leq .70$	.65	.71	(179)	(124)
$.50 < p \leq .60$	.56	.56	(198)	(143)
$.40 < p \leq .50$	.49	.45	(229)	(141)
$.30 < p \leq .40$	.37	.32	(282)	(165)
$.20 < p \leq .30$	.23	.22	(283)	(174)
$.10 < p \leq .20$	.11	.14	(189)	(198)
$0 \leq p \leq .10$	.07	.07	(260)	(211)
			(2041)	(1434)

longer in high school. In each case, 10 comparisons of predicted and actual results are shown, corresponding to the decile of the predicted probability of scoring in categories I-IIIA.

The figures indicate that the AFQT estimation method produces accurate results for both respondent groups. In each case, the predicted probabilities of scoring in categories I-IIIA are well-distributed across the entire possible range, and they are in close agreement with the actual proportions of test-takers scoring at or above the 50th percentile. For example, among the persons in each respondent group whose estimated probability of scoring in categories I-IIIA exceeds .90, the actual proportion scoring at or above the 50th percentile is .93 for high school students and .92 for those not in high school. The actual proportion scoring in categories I-IIIA declines steadily in close accordance with the predicted probability; among the test-takers

estimated to have a probability of .10 or less of scoring in categories I-IIIA, the proportion doing so is .07 in each group.[1]

Table 4 addresses the reliability of the AFQT estimation method. The table presents percentage information for test-takers similar to that contained in Table 3; this time, however, the results are based on the spring 1976–1980 YATS waves. As noted earlier, the characteristics of spring YATS interviewees differ from those of fall interviewees in ways that could affect the parameter estimates, and, for that reason, we modeled AFQT category using the fall waves only. (Recall that the YATS is now administered annually in the fall.) Thus, using the spring dataset to assess the reliability of the method may understate the true reliability. Specifically, the spring high school sample has a

Table 4

COMPARISON OF PREDICTED AND ACTUAL AFQT RESULTS FOR TEST-TAKERS IN SPRING 1976-1980 YATS WAVES

	Actual Proportion Scoring in Categories I-IIIA		(Number)	
Predicted Probability of Scoring in Categories I-IIIA	High School Students	Respondents Not in High School	High School Students	Respondents Not in High School
$.90 < p \leq 1.00$	.98	.89	(47)	(38)
$.80 < p \leq .90$	.88	.79	(140)	(73)
$.70 < p \leq .80$	.82	.78	(164)	(86)
$.60 < p \leq .70$	.70	.68	(167)	(96)
$.50 < p \leq .60$	.61	.61	(216)	(109)
$.40 < p \leq .50$	.54	.51	(226)	(106)
$.30 < p \leq .40$	.37	.39	(297)	(132)
$.20 < p \leq .30$	.28	.30	(264)	(130)
$.10 < p \leq .20$	.16	.13	(203)	(162)
$0 \leq p \leq .10$	.07	.06	(263)	(186)
			(1987)	(1118)

[1]Parenthetically, the estimation method captures the aptitude difference between test-takers and the general youth population mentioned earlier. The mean estimated probability of scoring in categories I-IIIA is .44 for the sample of high school test-takers and .54 for the entire sample of high school students; .41 for the sample of test-takers no longer in high school, and .54 for the entire sample of non-high school students.

higher percentage of sophomores because more sophomores meet the 16-years-old minimum age requirement for the survey. Also, the high school students are six months older than in the fall waves; thus, more seniors are 18 years old when interviewed. Finally, some students drop out of high school between the fall and the spring. As a result, the remaining high school students tend to be smarter than the fall group, and the spring nongraduate group—which captures these recent dropouts—is younger than the fall nongraduate group.

Despite these differences, the results in Table 4 clearly support the reliability of the estimation procedure. As is true for the fall waves, the predicted probabilities are well-distributed and correspond to the actual proportions of the test-takers scoring in categories I-IIIA. As would be expected, the correspondence is not quite as close as for the original fall waves, but the degradation is not serious. For example, among the respondents whose estimated probability of scoring in categories I-IIIA exceeded .90, the actual proportion scoring at or above the 50th percentile was .98 for high school students and .89 among those not in high school. In contrast, among those whose predicted probability of scoring in categories I-IIIA was .10 or less, the actual proportion scoring in these categories was .07 and .06, respectively.

As will be discussed in Sec. IV, a key application of the AFQT estimation method is to enable researchers to profile the characteristics of high aptitude youths on enlistment-related variables. Before such applications are made, we must be certain that the method generates profiles that are accurate and reliable.[2] Table 5 addresses the accuracy of high aptitude youth profiles based on the AFQT estimation method. The table shows actual and estimated percentage distributions on several important variables for AFQT category I-IIIA test-takers in the fall 1976–1980 surveys. The predicted distributions were generated by weighting each test-taker by his conditional probability of scoring in AFQT categories I-IIIA. The sum of the weights for a particular subgroup—e.g., Northeast region—was divided by the sum of the weights over all test-takers to determine the percentage of high aptitude test-takers predicted to fall in that subgroup. Results for respondents attending high school when surveyed are presented in columns one and two. The third and fourth columns show results for respondents not in high school. Clearly, the actual and estimated profiles correspond closely in both cases. (Additional profile information is shown in the Appendix.)

[2]As noted earlier, test-takers are not representative of the general youth population; thus, their profiles should not be assumed to be representative of that population. Section IV provides enlistment-related information for the general population.

Table 5

COMPARISON OF ACTUAL AND ESTIMATED PERCENTAGE DISTRIBUTIONS FOR FALL 1976–1980 YATS RESPONDENTS TAKING THE AFQT[a]

Characteristic	Percentage Distribution of Category I-IIIA AFQT-Takers			
	In High School at Survey		Not in High School at Survey	
	Actual Distribution (N = 889)	Estimated Distribution (N = 2041)	Actual Distribution (N = 590)	Estimated Distribution (N = 1434)
Region				
Northeast	20.3	21.3	23.0	24.5
North central	32.6	32.0	29.0	28.1
South	31.3	30.1	31.4	31.4
West	16.8	16.6	16.6	16.0
Employment status (at survey)				
Employed full-time	3.9	3.7	49.5	49.4
Employed part-time	46.7	45.9	23.5	22.9
Looking for work	28.2	30.5	18.5	19.9
Out of labor force	21.2	19.9	8.5	7.8
Race				
White, non-Hispanic	90.0	90.1	91.2	90.9
Black	6.1	6.0	5.4	5.6
Other nonwhite	3.9	4.0	3.4	3.5
Educational status (at survey)				
Not high school graduate	100.0	100.0	13.7	13.9
High school graduate, not attending college	0.0	0.0	57.5	57.4
High school graduate, attending college	0.0	0.0	28.8	28.7

[a]The "actual distribution" percentages represent the characteristics of persons who actually received AFQT scores in categories I-IIIA. The "estimated distribution" percentages are based on the characteristics of all AFQT-takers; each test-taker's results are weighted by his estimated probability of scoring in categories I-IIIA.

Table 6 addresses the profile generation reliability of the AFQT estimation method. The results in Table 6 are based on analyses similar to those reflected in Table 5; in this case, they show percentage distributions for AFQT-takers interviewed in the spring 1976–1980 YATS waves. As is the case for the fall 1976–1980 waves, there is a close correspondence between the actual and estimated distributions of category I-IIIA AFQT-takers on the characteristics in the table. This is true both for respondents who were in high school when they were interviewed and for those who were not. These results provide strong support for the reliability of the AFQT estimation method in generating profiles of category I-IIIA youths.

Table 6

COMPARISON OF ACTUAL AND ESTIMATED PERCENTAGE DISTRIBUTIONS FOR SPRING 1976–1980 YATS RESPONDENTS TAKING THE AFQT[a]

Characteristic	Percentage Distribution of Category I-IIIA AFQT-Takers			
	In High School at Survey		Not in High School at Survey	
	Actual Distribution (N = 909)	Estimated Distribution (N = 1987)	Actual Distribution (N = 468)	Estimated Distribution (N = 1118)
Region				
Northeast	22.2	24.6	19.0	20.7
North central	30.4	30.2	31.4	29.5
South	31.8	29.3	35.3	36.2
West	15.6	15.9	14.3	13.6
Employment status (at survey)				
Employed full-time	3.3	4.3	54.3	51.5
Employed part-time	43.3	41.9	16.2	18.5
Looking for work	38.4	39.4	19.9	21.7
Out of labor force	15.0	14.4	9.6	8.3
Race				
White, non-Hispanic	89.6	88.9	89.9	91.3
Black	5.8	6.6	6.0	5.5
Other nonwhite	4.6	4.5	4.1	3.2
Educational status (at survey)				
Not high school graduate	100.0	100.0	17.9	16.5
High school graduate, not attending college	0.0	0.0	56.7	56.9
High school graduate, attending college	0.0	0.0	25.4	26.6

[a]The "actual distribution" percentages represent the characteristics of persons who actually received AFQT scores in categories I-IIIA. The "estimated distribution" percentages are based on the characteristics of all AFQT-takers; each test-taker's results are weighted by his estimated probability of scoring in categories I-IIIA.

IV. AFQT-BASED ANALYSIS OF SELECTED RESULTS FROM THE 1985 YATS SURVEY[1]

This section illustrates the key analytic possibility made available by the aptitude estimation method: providing data summaries for different education and aptitude subgroups. This type of analysis enhances the usefulness of survey data in guiding advertising and recruiting policy, given the services' emphasis on recruiting category I-IIIA seniors and high school diploma graduates and the known differences in enlistment decisionmaking among education subgroups, discussed earlier. Here, we apply the estimation equations to results obtained for young male respondents to the 1985 YATS survey. This section illustrates the analytic potential of the estimation method; it does not provide a definitive analysis of the relationship between aptitude and the enlistment-related factors discussed below.

Since these individuals were sampled from the general youth population, the procedures for a nonselected sample are used to estimate the probability that each individual would score at or above the 50th percentile if he took the AFQT (categories I-IIIA), as described in Sec. II. A low aptitude probability—equal to one minus the probability of scoring in categories I-IIIA—is also computed. This procedure allows us to prepare data summaries for high and low aptitude youth.

Given the emphasis on recruiting high school seniors and diploma graduates and the differences in the factors associated with enlistment in high school versus non-high school markets, the YATS results were analyzed for four groups according to education status: (1) high school diploma graduates; (2) high school seniors; (3) younger high school students; and (4) nongraduates, i.e., individuals without high school diplomas who are not continuing in high school. Only respondents with regular high school diplomas were classified as high school diploma graduates; persons with GEDs (General Equivalency Diplomas) or ABE (Adult Basic Education) certificates were classified as nongraduates.

Each of the graduate and student groups was divided into two subgroups: AFQT category I-IIIA or AFQT category IIIB-V. Because of the services' lesser interest in recruiting nongraduates, the nongraduate group was not divided. The mean estimated probabilities of scoring in

[1]This section originally appeared in a slightly different form as Chapter 10, "AFQT-Based Analysis of Results for Young Men," in *Youth Attitude Tracking Study II: Fall 1985*, R. M. Bray et al., Research Triangle Institute, Research Triangle Park, North Carolina, June 1986.

AFQT categories I-IIIA (i.e., the proportions of persons who would score in these categories) were .596 for high school diploma graduates, .642 for high school seniors, and .514 for younger high school students. Information on the predicted characteristics of category I-IIIA and category IIIB-V youth within each school group is presented in the Appendix.

In the remainder of this section, we use the high school status-AFQT category grouping framework to examine several broad issues, as described below. For each issue, the implications of the overall results and any differences among the groups for advertising and recruiting efforts will be discussed. (Procedures for making statistical comparisons among the groups are discussed in the Appendix.)

1. What proportion of the persons in each group indicate they are likely to enlist, and how do the positive enlistment propensity levels for the groups differ?
2. What are the rates of taking actions toward enlistment, such as discussing enlisting with someone or talking to a recruiter?
3. Does the pattern of recruiter contacts for the groups differ by service?
4. What are the groups' plans for the coming year (or after high school), and how does enlistment propensity vary with these plans?
5. How aware are the groups of military advertising, and how does awareness vary by advertising medium? What is the total market coverage provided by all the media? Are there shortfalls or differences in awareness among the groups that might be addressed to lessen the difficulty of recruiting high aptitude youth?
6. What do the groups know about military pay and enlistment incentives, and are there shortfalls or differences in knowledge that might be addressed to lessen the difficulty of recruiting high aptitude youth?
7. How much importance do the groups attach to various job characteristics, and what is the perceived availability of the characteristics in military versus civilian jobs?

Since a considerable amount of detailed information is presented in the remainder of this section, we summarize the results briefly here. There are general differences between the aptitude groups on measures reflecting one's interest in enlisting in the military. Low aptitude youth have more positive enlistment propensity and are more likely to have taken actions related to enlistment. The analysis suggests that these differences are **not** attributable to lower levels of awareness of

advertising for the military or of knowledge about military pay and enlistment incentives among high aptitude youth, nor to differences in perceptions of military job characteristics. However, the results highlight some apparent shortfalls in awareness that, if addressed, may help recruiting efforts.[2]

POSITIVE PROPENSITY LEVELS

Table 7 shows stated propensity to enlist in the military by high school status and AFQT category. In the upper panel, propensity measures for each of the active-duty services are shown, as well as the composite measure of propensity to enlist in any active-duty service. The lower panel shows propensity for the National Guard, the Reserves, and for a composite measure of propensity to enlist in the Guard/Reserves. The finding is the same for each measure: the propensity of high school students to enlist is much greater than that of high school graduates, and the estimated propensity of AFQT category IIIB-V youths is much greater than that of category I-IIIA youths. On the composite active propensity measure, for example, category IIIB-V high school students are estimated to have a positive propensity level nearly 15–20 percentage points greater than category I-IIIA high school students (46.2 versus 24.7 percent for seniors and 48.8 versus 33.6 percent for juniors and sophomores); the difference in estimates between category IIIB-V and category I-IIIA high school graduates is nearly 15 percentage points (27.0 versus 12.7 percent).[3] Differences between the high school student and high school graduate groups are also large and can be explained partially by the fact that high school graduation is a natural enlistment decision point. Since enlistees have been excluded from the YATS—and since enlistment is related to positive propensity—respondents in post-high school groups will tend to express lower enlistment propensities.

ACTIONS TAKEN TOWARD ENLISTMENT

Table 8 shows the estimated rates of taking various actions toward enlistment for each group. The actions are presented in order of decreasing frequency, and include discussing enlisting with someone

[2]Strategies to remedy these shortfalls are explored in the concluding chapter.

[3]The difference in estimated positive propensity levels between high school graduates in AFQT categories I-IIIA and categories IIIB-V cannot be attributed to the higher concentration of college students in the former group. The estimated positive propensity rates differ by AFQT for both students and nonstudents.

Table 7

POSITIVE PROPENSITY FOR MILITARY SERVICE

Positive Propensity Measure	High School Status and AFQT Category							
	High School Graduates (N = 2127)		High School Seniors (N = 883)		Younger High School Students (N = 1166)		Nongraduates (N = 1302)	Total (N = 5478)
	Category		Category		Category			
	I-IIIA	IIIB-V	I-IIIA	IIIB-V	I-IIIA	IIIB-V		
Active propensity								
Army	4.4	12.8	9.8	26.0	14.9	25.3	21.0	14.7
Navy	5.4	11.5	7.6	16.9	10.6	16.3	12.7	10.6
Marine Corps	3.2	8.0	9.2	20.1	9.7	18.6	13.4	10.2
Air Force	7.1	14.3	13.1	21.4	19.3	25.1	16.0	14.9
Composite active propensity	12.7	27.0	24.7	46.2	33.6	48.8	36.7	29.8
Reserve propensity								
National Guard	5.2	12.1	8.6	19.1	12.1	20.0	13.2	11.6
Reserves	8.0	16.9	15.2	27.9	17.5	26.1	17.0	16.3
Composite Reserve propensity	10.5	21.8	19.6	35.4	21.5	33.4	21.8	20.8

SOURCE: Questions 505, 507, 510–513.

NOTE: Entries are estimated percentages for male respondents ages 16–21 years, based on their predicted probability of scoring in the indicated AFQT categories and their YATS sample weight. All differences between propensity estimates for category I-IIIA versus category IIIB-V youths within school groups are significant at the $p < .05$ level.

Table 8

ACTIONS TAKEN TOWARD ENLISTMENT

Action Taken[a]	High School Graduates (N = 2127)		High School Seniors (N = 883)		Younger High School Students (N = 1166)		Nongraduates (N = 1302)	Total (N = 5478)
	Category		Category		Category			
	I-IIIA	IIIB-V	I-IIIA	IIIB-V	I-IIIA	IIIB-V		
Discussed military service with someone	38.2	41.0[b]	51.8	55.1	39.6	42.7	42.0	42.5
Had contact with recruiter	50.0	51.8	38.1	42.3	20.5	25.4[b]	38.2	40.1
Had contact with recruiter this year	21.4	22.8	30.2	33.3	14.2	14.8	20.1	21.4
Took ASVAB	30.2	34.4[b]	17.7	19.3	6.7	5.5	15.9	20.4
Mailed postcard or coupon	10.4	10.9	13.6	14.5	6.4	7.0	8.9	9.9
Made toll-free call	2.7	3.3	2.5	4.4[b]	0.6	0.8	2.8	2.5

SOURCE: Questions 622, 625, 628, 633, 636, 639, 642, 645, 683.

NOTE: Entries are estimated percentages for male respondents ages 16–21 years, based on their predicted probability of scoring in the indicated AFQT categories and their YATS sample weight.

[a]Discussed service refers to "within the last year or so"; recruiter contact and took ASVAB refer to "ever"; recruiter contact this year refers only to this calendar year; and mailed card and made toll-free call refer to "within the last 12 months."

[b]Difference in rate estimates for category I-IIIA versus category IIIB-V youths within indicated school group is significant at $p < .05$ level.

during the past year or so, talking to a recruiter at any time in the past, talking to a recruiter in 1985, taking the ASVAB, mailing a postcard or coupon for information on the military, and making a toll-free call for information. Beginning with the first row of the table, we find that about half of the seniors and 40 percent of the other groups discussed the possibility of enlisting with someone during the past year. The fact that the rates are highest for seniors reflects the observation made earlier: seniors are at their natural enlistment decision point; high school graduates and nongraduates no longer in high school have passed that point without enlisting, and younger students have not yet reached the point where they must decide whether to enlist after high school. The discussion about enlisting measure captures this dimension, because it asks about recent conversations—during the past year or so.

AFQT category I-IIIA youths are estimated to be somewhat less likely to have discussed the possibility of enlisting than category IIIB-V youths. The magnitudes of the estimate differences between the AFQT groups are about what one would expect given their respective positive propensity levels and the different rates of discussing enlistment found among persons with positive versus negative propensity. Over all respondents, the differences reflect a statistically significant decrease in the discussion rate as the probability of obtaining a high AFQT score increases. However, they are not large in absolute terms, and only the difference for high school graduates is statistically significant. As a result, a large proportion of the category I-IIIA high school graduate market and half of the category I-IIIA high school senior market may be expected to discuss the possibility of enlisting with other individuals during a given year. This implies that advertising, recruiter presentations, and literature about military opportunities might be directed profitably at a wider audience than just the potential recruit himself, such as parents, other family members, friends, and teachers, with whom the individual is likely to have such discussions.

The next most frequent action consists of having talked to a military recruiter at any time in the past. About 50 percent of the high school graduates, 40 percent of the high school seniors and nongraduates, and 20–25 percent of the younger high school students report they have talked to a recruiter. The overall pattern corresponds to the ages of the respondents in the given groups, since the measure concerns lifetime contacts. As for discussions about enlisting, the magnitudes of the estimate differences between the AFQT groups are about what one would expect given their respective positive propensity levels, and they are not large in absolute terms. Comparing the recruiter contact levels for the different groups—and remembering that the survey is fielded in late summer to

early fall—makes it clear that many contacts are initiated during the junior and senior years of high school. Recruiter contact levels rise 15–20 percentage points by the early senior year as compared to younger students' levels, and they rise another 10 points thereafter. Interestingly, rates of contact with recruiters appear to differ significantly by AFQT among the younger high school students, and this difference persists at nearly the same level into the senior year. Given the tendency to make recruiter contacts during the junior year and the difference in estimated contact rates between AFQT groups, this period may represent a good time to take actions to increase the rate of contacts among category I-IIIA students, which, ideally, would equal or surpass that found among category IIIB-V students.

The third most frequent action consists of having talked to a military recruiter in 1985. This measure is probably a better indicator of current interest in enlisting than lifetime recruiter contacts, since it reflects recent contacts and, thus, removes age as a factor for the older respondents. Consistent with this reasoning, the pattern of contact rates for seniors and high school graduates is reversed from that observed for lifetime contacts. Seniors show the highest rate of recent recruiter contacts, followed by graduates and nongraduates no longer in high school, with younger students the lowest. This reflects the enlistment decision sequence noted earlier and, more generally, the propensity results in Table 7. Younger high school students have apparently not yet acted fully on their positive propensity. Thus, although their positive propensity level is as high as that for seniors, their discussion rate and, especially, recruiter contact rate are lower than the corresponding rates for seniors. As observed above, the high recruiter contact rate for seniors indicates that many contacts are made during the junior year (or very early in the senior year). Again, the period between early junior and senior years may be a time when special action could be taken to offset the lower rate with which category I-IIIA students appear to make recruiter contacts under the current system. Recruiter contact differences between the AFQT groups will be examined for the individual services below.

The next action is having taken the ASVAB at any time in the past. Since the time frame is the respondent's lifetime, the measure shows the same age pattern seen for lifetime recruiter contacts. High school graduates show the highest rates, followed by seniors, nongraduates, and younger high school students. Judging by the overall results, the tests would appear to represent institutional ASVAB administrations for the most part, with the possible exception of the high school graduates' tests. Institutional tests (given at high schools) are administered routinely to large groups of students, and thus the act of taking the

test may not reflect an interest in joining the military. In contrast, production ASVABs (administered at MEPS or mobile examining team sites) must be scheduled by recruiters at the expressed interest of the examinee. Consistent with this reasoning, only among the graduates does the estimated rate of taking the ASVAB vary significantly with AFQT.

The rates of taking the remaining actions—mailing a postcard or making a call for information—are lower and suggest little difference between the AFQT groups. The one significant estimate difference shows a lower rate of making a toll-free call for information among category I-IIIA high school seniors.

RECRUITER CONTACTS BY SERVICE

We next examine contacts with recruiters for the individual services to see if they show the same differences by high school status and AFQT category as the overall recruiter contact results. Table 9 shows these contacts for two measures: lifetime contacts and contacts during 1985. For ease of comparison, the overall rates of recruiter contact regardless of service are repeated for the two measures from Table 8. The Army has the highest rate of recruiter contacts. The rates for the other services are considerably lower and are relatively uniform, with the exception that Marine Corps contact estimates for category IIIB-V high school students are closer to the Army rates than to those for the Navy and Air Force. For the Army and the Marine Corps, the results for the two measures resemble those seen in Table 8. Contacts with these services on the lifetime measure are higher for high school graduates than for high school seniors and younger high school students, whereas recent contacts with these services are highest among high school seniors. Moreover, estimated contact rates for category I-IIIA youths are lower than for category IIIB-V youths. These patterns are less apparent for contacts with Navy and Air Force recruiters, however. In particular, the rates of recent contacts with recruiters for these services do not differ much between high school graduates and seniors. Moreover, the estimated rates of contacting recruiters for these services for category I-IIIA youths tend to be as high (or higher) as those estimated for category IIIB-V youths. In sum, contacts with recruiters for any individual service are made by a relatively small proportion of young men. The Army appears to have the highest rate of recruiter contacts, but some special effort to boost contacts with AFQT category I-IIIA youths may be needed if the rate of contact with high aptitude youths is to equal or surpass that with lower AFQT youths. As noted,

Table 9

RECRUITER CONTACTS BY SERVICE

Recruiter Contact	High School Graduates (N = 2127) Category I-IIIA	High School Graduates (N = 2127) Category IIIB-V	High School Seniors (N = 883) Category I-IIIA	High School Seniors (N = 883) Category IIIB-V	Younger High School Students (N = 1166) Category I-IIIA	Younger High School Students (N = 1166) Category IIIB-V	Nongraduates (N = 1302)	Total (N = 5478)
Lifetime								
Army	27.4	29.4	16.9	20.8[a]	8.1	11.8[a]	23.2	21.5
Navy	16.5	16.0	9.0	7.8	6.6	6.5	9.8	11.4
Marine Corps	14.6	16.3	11.8	16.3[a]	6.7	9.7[a]	10.4	12.3
Air Force	12.6	12.9	8.5	6.1	8.2	7.6	7.8	9.7
Any military recruiter	50.0	51.8	38.1	42.3	20.5	25.4[a]	38.2	40.1
This year								
Army	11.0	12.5	14.1	16.5	4.7	5.8	11.2	10.7
Navy	6.5	7.2	7.5	5.2	4.2	3.6	5.8	5.9
Marine Corps	6.8	6.8	10.1	14.1[a]	5.1	6.9[a]	4.9	6.9
Air Force	5.1	5.6	4.8	3.9	5.3	3.2[a]	3.7	4.6
Any military recruiter	21.4	22.8	30.2	33.3	14.2	14.8	20.1	21.4

SOURCE: Questions 628, 629, 633, 636, 639, 642.

NOTE: Entries are estimated percentages for male respondents ages 16–21 years, based on their predicted probability of scoring in the indicated AFQT categories and their YATS sample weight.

[a]Difference in rate estimates for category I-IIIA versus category IIIB-V youths within indicated school group is significant at $p < .05$ level.

the same self-selection problem appears to apply to contacts with Marine Corps recruiters.

PLANS FOR NEXT YEAR (OR AFTER HIGH SCHOOL)

Up to this point, we have reviewed differences in enlistment propensity and other measures of interest in enlistment among the high school-AFQT groups. We now begin to examine factors that may influence enlistment interest. Table 10 shows the percentage distribution of most likely plans for the next year, or the year after high school, among several alternatives for each group. There are large differences in plans according to high school status. Seniors and younger high school students are significantly more likely to plan to attend school full-time the year after they finish high school than high school graduates or nongraduates no longer in high school are to plan full-time school attendance in the next year. In contrast, high school graduates and nongraduates are more likely to indicate that they plan to work full-time. Consistent with the enlistment propensity results shown earlier, plans to serve in the military are most common among respondents in high school.

There are also significant differences in plans between the AFQT groups. Category I-IIIA youths are estimated to be much more likely than category IIIB-V youths to plan full-time school attendance; conversely, category IIIB-V youths are estimated to be more likely to intend to work full-time, and, to a lesser extent, to serve in the military. The data suggest clearly that the military is competing with full-time school attendance for the majority of AFQT category I-IIIA youths. This is especially true for seniors and younger high school students. For lower aptitude high school students, the opportunity to recruit from the school and labor markets seems more balanced. Still, it appears that more lower aptitude students plan to continue their education after high school than to work. Finally, for AFQT category IIIB-V high school graduates and for nongraduates no longer in high school, the pattern is reversed. For such persons, the results suggest that the military is competing more with the full-time labor market than with full-time school attendance.

How do the differences in most likely plans relate to the propensity differences among the groups? First, the differences in plans to serve in the military mirror the groups' differences in composite active propensity seen in Table 7. What about differences in school and job plans? The difference between the AFQT group estimates concerning plans to attend school full-time versus work full-time is striking.

Table 10

MOST LIKELY PLANS FOR NEXT YEAR (OR AFTER HIGH SCHOOL)

	High School Status and AFQT Category							
	High School Graduates (N = 2127)		High School Seniors (N = 883)		Younger High School Students (N = 1166)			
	Category		Category		Category			
Most Likely Plans	I-IIIA	IIIB-V	I-IIIA	IIIB-V	I-IIIA	IIIB-V	Nongraduates (N = 1302)	Total (N = 5478)
Go to school full-time	52.2	31.8[a]	69.9	42.8[a]	62.7	41.4[a]	31.4	45.4
Go to school part-time	6.4	8.0[a]	6.3	10.7[a]	8.6	11.0[a]	9.9	8.4
Work full-time	35.2	49.1[a]	15.4	27.7[a]	14.5	24.6[a]	42.0	33.2
Work part-time	1.7	3.0[a]	1.8	3.9[a]	2.7	3.8	4.1	2.9
Serve in the military	0.7	3.8[a]	3.5	11.0[a]	9.0	14.8[a]	7.4	6.0
Other	2.6	2.3	2.6	2.9	1.3	2.4[a]	3.4	2.6
Don't know	1.2	2.0[a]	0.5	0.9	1.2	2.0	1.8	1.5

SOURCE: Question 517.

NOTE: Entries are estimated percentages for male respondents ages 16-21 years, based on their predicted probability of scoring in the indicated AFQT categories and their YATS sample weight.

[a]Difference in rate estimates for category I-IIIA versus category IIIB-V youths within indicated school group is significant at $p < .05$ level.

Table 11

POSITIVE PROPENSITY LEVEL BY MOST LIKELY PLANS

	High School Status and AFQT Category							
	High School Graduates (N = 2127)		High School Seniors (N = 883)		Younger High School Students (N = 1166)			
	Category		Category		Category			
Most Likely Plans	I-IIIA	IIIB-V	I-IIIA	IIIB-V	I-IIIA	IIIB-V	Nongraduates (N = 1302)	Total (N = 5478)
Go to school full-time	11.8 (N = 972)	26.0[a]	18.5 (N = 529)	34.5[a]	22.2 (N = 622)	33.5[a]	27.7 (N = 402)	21.8 (N = 2525)
Go to school part-time	18.3 (N = 154)	34.9[a]	37.9 (N = 78)	56.6[a]	37.8 (N = 108)	47.5	43.2 (N = 123)	38.0 (N = 463)
Work full-time	10.3 (N = 838)	20.4[a]	25.9 (N = 165)	39.2[a]	41.1 (N = 226)	45.5	31.9 (N = 545)	25.4 (N = 1774)
Work part-time	10.9 (N = 45)	31.3[a]	31.3 (N = 27)	44.6	23.4 (N = 35)	47.7[a]	29.5 (N = 57)	30.3 (N = 164)
Serve in the military	100.0 (N = 41)	100.0	100.0 (N = 58)	100.0	97.7 (N = 132)	97.4	97.5 (N = 100)	98.2 (N = 331)
Other	24.9 (N = 42)	36.6[a]	40.3 (N = 19)	52.8	42.4 (N = 22)	49.2	38.0 (N = 47)	37.3 (N = 130)
Don't know	22.1 (N = 35)	21.3	-- (N = 7)	--	45.4 (N = 21)	58.2	31.4 (N = 28)	32.7 (N = 91)

SOURCE: Question 517.

NOTE: Entries are estimated percentages for male respondents ages 16-21 years, based on their predicted probability of scoring in the indicated AFQT categories and their YATS sample weight. Entries show the positive propensity level on the composite active propensity measure for the indicated group.

[a]Difference in rate estimates for category I-IIIA versus category IIIB-V youths within indicated school group is significant at $p < .06$ level.

Given the large difference in estimated enlistment propensity by AFQT, this difference in plans raises a logical question as to whether planning to attend school full-time is more strongly associated with negative propensity and, thus, whether the difference in plans between the AFQT groups might be a contributing factor to their difference in enlistment propensity.

To enable us to examine this issue more closely, Table 11 shows positive composite active propensity level according to both high school-AFQT group and most likely plans. Note that in each group, persons indicating they plan to serve in the military have a positive propensity level of nearly 100 percent. For persons planning to attend school full-time or work full-time, the relationship of these plans to their enlistment propensity varies with high school status. Among high school graduates, persons planning to attend school full-time are equally or, if anything, somewhat *more* likely to express positive propensity than those planning to work full-time. Indeed, a regression analysis of these results indicates that if we control for estimated AFQT differences between graduates planning to attend school and graduates planning to work, the former express significantly higher propensity.[4] For younger high school students, however, this is not the case. For this group, plans to attend school full-time (after high school) are associated with lower enlistment propensity than plans to work full-time, regardless of AFQT level. The picture for high school seniors is complex. Taken as a whole, seniors planning to attend school full-time (after high school) are less likely to express positive propensity than those planning to work full-time. However, this pattern is apparently attributable to the higher aptitude of the seniors who plan to attend school. When this difference in estimated AFQT scores is accounted for, the results suggest that the positive propensity level is comparable among seniors planning to attend school and seniors planning to work. The pattern for nongraduates no longer in high school most closely resembles that of category IIIB-V high school seniors.

Taken together, the results in Tables 10 and 11 suggest that the military is competing more with the school market than with the labor market for AFQT category I-IIIA youths. This is especially true for high aptitude high school students, as compared to high aptitude high school graduates. The results in Table 11 suggest that category I-IIIA high school graduates who plan to attend school full-time in the coming year

[4]This finding results from the higher average AFQT score of graduates planning to attend school full-time which, if not controlled, lowers the estimated enlistment propensity level of this group and makes it appear more similar to the propensity level among graduates planning to work full-time.

may be no more difficult to recruit than those planning to work full-time (ignoring any possible differences in the difficulty of locating the two groups). Moreover, graduates with *equivalent* AFQT scores may be easier to recruit if they plan to attend school than if they plan to work. These results are generally consistent with those reported by Hosek and Peterson (1985) in their analysis of the enlistment decisions of young men. They found that expectations for continued education are positively related to enlistment among non-student high school graduates. For high school seniors, the results are mixed. In general, seniors in categories I-IIIA who plan to attend school full-time after high school are likely to be more difficult to recruit than those planning to work full-time. However, this difference is apparently attributable to the higher aptitude of those planning school. Among those with equivalent AFQT scores, there appears to be little difference in propensity between seniors planning school and those planning to work. Finally, for younger high school students in categories I-IIIA, interesting those who plan to work full-time after high school in military service may be easier than creating interest among those who plan to attend school full-time. The propensity estimates in Table 11 suggest that younger high school students in categories I-IIIA who plan to work full-time may also be considering military service to a greater extent than their senior counterparts; their positive propensity level appears to be considerably higher. This accounts for the difference in the findings for seniors and younger students.

AWARENESS OF ADVERTISING

We now examine awareness of military advertising and receipt of unsolicited recruiting literature among the high school-AFQT groups. Table 12 has three sections. The upper section shows the percentages of the various groups that recall seeing or hearing broadcast advertising for the military during the past year. Results are presented for the individual active services, the National Guard/Reserves, and for joint service advertising. The last row of the section shows the percentages aware of any broadcast advertising, regardless of sponsor. The middle section of the table follows the same format, but presents results for print advertising. The bottom section shows figures for receipt of recruiting literature (at any time in the past), using the same format. We will examine each of the topics in turn.

Overall, there is very high awareness of broadcast advertising for the military. The last row of the first section of Table 12 indicates that 80–90 percent of the respondents recall seeing or hearing broadcast advertising for some military service during the past year. Recall of

Table 12

AWARENESS OF BROADCAST AND PRINT MEDIA ADVERTISING AND RECEIPT OF RECRUITING LITERATURE

	High School Status and AFQT Category							
	High School Graduates (N = 2127)		High School Seniors (N = 883)		Younger High School Students (N = 1166)			
	Category		Category		Category		Nongraduates (N = 1302)	Total (N = 5478)
Medium and Service	I-IIIA	IIIB-V	I-IIIA	IIIB-V	I-IIIA	IIIB-V		
Saw/heard broadcast advertising from:								
Army	53.9	55.4	54.6	57.7	53.8	54.6	50.6	53.7
Navy	36.6	33.1[a]	37.9	35.5	37.3	35.5	33.4	35.3
Marine Corps	43.6	42.5	46.2	45.9	43.0	46.0	38.0	42.7
Air Force	42.6	41.5	46.5	46.1	44.6	43.3	38.4	42.3
National Guard/ Reserves	18.5	16.4[a]	15.9	12.8	14.1	12.2	15.4	15.7
Joint services	32.4	27.8[a]	34.5	27.7[a]	31.4	24.3[a]	23.9	28.7
Any service	88.9	85.5[a]	90.3	89.0	88.8	86.6	80.0	86.2
Saw print advertising of:								
Army	49.7	48.7	55.2	51.8	48.5	45.1	44.9	48.5
Navy	29.5	26.6[a]	27.5	24.4	24.6	22.8	21.9	25.5
Marine Corps	36.3	34.2	36.6	37.4	32.2	30.3	29.7	33.4
Air Force	36.3	35.0	41.6	38.2	39.9	36.0[a]	28.8	35.4
National Guard/ Reserves	9.2	8.1	9.8	10.2	6.9	6.4	6.8	8.0
Joint services	17.6	15.1[a]	21.4	18.4	14.2	12.7	13.0	15.7
Any service	77.8	74.1[a]	84.6	81.9	76.8	72.7[a]	67.8	75.2
Received literature from:								
Army	41.1	34.8[a]	43.6	40.3	10.6	10.2	22.3	29.3
Navy	23.7	20.7[a]	26.8	21.3[a]	2.3	3.0	9.9	15.7
Marine Corps	28.5	24.3[a]	29.6	27.4	4.9	5.7	16.9	20.2
Air Force	23.0	20.5[a]	23.0	16.9[a]	2.5	3.0	12.0	15.4
National Guard/ Reserves	4.5	4.1	7.7	6.3	1.8	1.3	3.0	3.9
Joint services	5.8	4.0[a]	8.4	5.9[a]	0.3	0.2	3.9	4.2
Any service	62.2	55.3[a]	66.6	60.6[a]	17.0	16.5	38.6	46.3

SOURCE: Questions 616–621.

NOTE: Entries are estimated percentages for male respondents ages 16–21 years, based on their predicted probability of scoring in the indicated AFQT categories and their YATS sample weight.

[a]Difference in rate estimates for category I-IIIA versus category IIIB-V youths within indicated school group is significant at $p < .05$ level.

broadcast advertising for the individual services and components is considerably lower. Awareness levels are highest for the active duty services, followed by joint service advertising, and, finally, by broadcast advertising for the National Guard/Reserves. Among the active duty services, awareness of broadcast advertising is highest for the Army, followed by the Marine Corps and the Air Force, and is lowest for the Navy. There are no large differences in awareness of broadcast advertising among the high school-AFQT groups. Only a few of the differences are statistically significant; they suggest that AFQT category I-IIIA youths tend to be somewhat more aware of broadcast advertising than category IIIB-V youths. Thus, the results are reassuring in suggesting that broadcast advertising for the military is reaching as many high aptitude youths as lower aptitude youths. Lower awareness of broadcast advertising among high aptitude youths is not a likely explanation for their lesser enlistment interest reflected in the indicators reported earlier.

There is also high awareness of print advertising for the military. The last row of the second section of Table 12 indicates that 65–85 percent of the respondents recall seeing print advertising for some military service during the past year. Recall of print advertising for the individual services and components is considerably lower, and follows the same pattern as for broadcast advertising. Awareness levels are highest for the active duty services, followed by joint service advertising, and, finally, by print advertising for the National Guard/Reserves. Among the active duty services, awareness of print advertising is highest for the Army, followed by the Marine Corps and the Air Force, and is lowest for the Navy. Although the differences are somewhat larger than for broadcast advertising, there are still no big differences in awareness of print advertising among the groups. Again, a few of the differences are statistically significant, and suggest that AFQT category I-IIIA youths tend to be somewhat more aware of print advertising than category IIIB-V youths. They also suggest that awareness of print advertising in general, across all services, is greater among high school seniors than among the other groups. As true for broadcast advertising, the results are reassuring in suggesting that as many high aptitude youths as lower aptitude youths are being reached with print advertising.

The receipt of unsolicited recruiting literature is reported by fewer respondents than the proportions reporting awareness of broadcast or print advertising for the military. This is especially true for younger high school students. The last row of the last section of Table 12 indicates that 55–65 percent of the high school graduates and high school seniors report receiving unsolicited recruiting literature for some

military service at some time in the past. The figures for younger high school students and nongraduates are much lower, and for much the same reason: most literature is mailed during youths' senior year in high school. Reports of receiving literature for the individual services and components are considerably less common. Similar to recall of broadcast and print advertising, reported receipt levels are highest for the active duty services, followed by joint service literature, and, finally, by literature for the National Guard/Reserves. Among the active duty services, reported receipt of literature is highest for the Army, followed by the Marine Corps, and is lowest for the Air Force and Navy. The differences among the groups are larger than they were for broadcast or print advertising, and, as noted, clearly reflect the policy of mailing literature to high school seniors. Moreover, although not large in absolute terms, the differences between the AFQT subgroup estimates for many of the services among high school graduates and among seniors are statistically significant, and suggest that more AFQT category I-IIIA youths than category IIIB-V youths receive unsolicited recruiting literature. As is true for broadcast and print advertising, then, the results are reassuring in suggesting that recruiting literature is reaching as many high aptitude youths as lower aptitude youths.

Up to now, we have examined recall of broadcast and print advertising and the receipt of recruiting literature separately. Here we will examine recall of the combined media. Specifically, we are interested in the coverage of the market provided by all the media together. Given the results in Table 12, if the individual media reach different audiences, the Department of Defense might expect to reach almost all youths with the combined media. On the other hand, if there is substantial overlap in the audiences reached by the individual media, advertising may fail to reach many youths. Table 13 shows results on this issue. The upper portion of the table shows the percentage of each group that recalls seeing or hearing broadcast or print advertising for the military during the past year. The lower portion of the table also includes reported receipt of unsolicited recruiting literature, presenting results for all three media combined.

Overall, there is very high recall of recent advertising for the military. The last row of each part of Table 13 indicates that some 95 percent of the respondents recall seeing or hearing advertising for a military service during the past year or receiving unsolicited recruiting literature. Recall of advertising for the individual services and components is considerably lower. Awareness levels are highest for the active duty services, followed by joint service advertising, and, finally, by advertising for the National Guard/Reserves. The figures for the

Table 13

MARKET COVERAGE OF COMBINED ADVERTISING MEDIA

Media and Service	High School Graduates (N = 2127) Category I-IIIA	High School Graduates (N = 2127) Category IIIB-V	High School Seniors (N = 883) Category I-IIIA	High School Seniors (N = 883) Category IIIB-V	Younger High School Students (N = 1166) Category I-IIIA	Younger High School Students (N = 1166) Category IIIB-V	Nongraduates (N = 1302)	Total (N = 5478)
	High School Status and AFQT Category							
Aware of broadcast or print advertising:								
Army	69.3	70.4	74.4	73.7	69.9	69.7	66.4	69.7
Navy	48.6	44.8[a]	51.1	46.5[a]	46.8	44.6	43.8	46.4
Marine Corps	56.7	55.4	60.0	59.7	55.3	56.2	51.6	55.6
Air Force	56.2	55.5	62.5	60.1	61.9	57.6[a]	50.6	56.4
National Guard/ Reserves	22.8	19.7[a]	19.8	18.5	17.5	15.3	18.3	19.3
Joint services	37.5	32.8[a]	40.8	32.8[a]	35.1	28.4[a]	28.5	33.5
Any service	94.5	92.3[a]	96.6	96.1	94.4	93.5	89.2	93.1
Aware of broadcast/print advertising or received recruiting literature:								
Army	79.3	78.4	84.2	83.5	73.0	72.0	71.3	76.6
Navy	58.6	53.8[a]	61.6	55.8[a]	47.5	45.8	48.0	53.0
Marine Corps	66.7	64.2[a]	69.6	68.1	56.8	57.8	58.2	62.7
Air Force	64.2	62.2	70.3	65.2[a]	62.6	58.6[a]	55.9	61.8
National Guard/ Reserves	25.3	22.7[a]	24.4	21.8	19.1	16.4[a]	20.0	21.8
Joint services	39.3	34.0[a]	43.8	34.8[a]	35.1	28.4[a]	30.1	34.9
Any service	96.6	95.2[a]	98.0	98.3	95.2	93.9	91.6	95.0

SOURCE: Questions 616–621.

NOTE: Entries are estimated percentages for male respondents ages 16–21 years, based on their predicted probability of scoring in the indicated AFQT categories and their YATS sample weight.

[a]Difference in rate estimates for category I-IIIA versus category IIIB-V youths within indicated school group is significant at $p < .05$ level.

active duty services vary considerably. Awareness of advertising is highest for the Army. The bottom section of Table 13 suggests that Army coverage averages about 75 percent of all respondents and 80–85 of high school graduates and seniors in AFQT categories I-IIIA, considering all three media together, i.e., recall of recent Army advertisements or receipt of Army recruiting literature. The coverage rates for the Marine Corps and Air Force are substantially lower, and are lower still for the Navy. Overall coverage averages about 62 percent for the Marine Corps and Air Force, and about 53 percent for the Navy; coverage of high school graduates and seniors in categories I-IIIA appears to average about 65–70 percent for the Marine Corps and Air Force, and

about 60 percent for the Navy. Only 40 percent of these two high aptitude groups appear to be aware of recent joint service advertising, and only 20–25 percent aware of advertising for the National Guard or Reserves. As seen earlier for the individual media, the results are reassuring in suggesting that military advertising is reaching as many high aptitude youths as lower aptitude youths; thus, the lesser enlistment interest of high aptitude youths does not appear to be attributable to lower advertising awareness levels. However, large proportions of AFQT category I-IIIA high school graduates and seniors appear to be unaware of recent advertising for most of the active services or for the Guard/Reserves. Increased market coverage may help recruiting efforts.

KNOWLEDGE OF MILITARY PAY AND ENLISTMENT INCENTIVES

We next examine knowledge of military pay and enlistment incentives among the groups. Table 14 presents results concerning knowledge of military starting pay and two enlistment incentives: cash enlistment bonuses and post-service educational benefits. In comparison with the levels of awareness of military advertising discussed above, knowledge of pay and the enlistment bonus program is much less common. Awareness of educational benefits is considerably greater, but is still substantially lower than awareness of military advertising.

Approximately 25 percent of the respondents were able to provide estimates within $100 of actual starting pay—about $575 per month at the time of the survey. Knowledge of pay was significantly greater among high school graduates than among seniors or younger high school students, but even among graduates, only 25–30 percent provided close estimates. Knowledge of pay did not vary significantly by AFQT group except among graduates, where more category IIIB-V youths than category I-IIIA youths appear able to provide close estimates. With respect to misestimations of starting pay, there were no significant differences in the pattern of misestimations (i.e., underestimates versus overestimates) according to high school status or AFQT category.

Although knowledge of pay is low, the effect of increasing awareness of starting pay on enlistment propensity is unclear and probably not large. For one thing, although the medians of the pay values provided by the respondents who were able to estimate pay (i.e., those who did not indicate that they did not know the value) are somewhat low, they

Table 14

KNOWLEDGE OF MONTHLY STARTING PAY AND ENLISTMENT INCENTIVES

	High School Status and AFQT Category							
	High School Graduates		High School Seniors		Younger High School Students			
	Category		Category		Category			
Item	I-IIIA	IIIB-V	I-IIIA	IIIB-V	I-IIIA	IIIB-V	Nongraduates	Total
Monthly starting pay[a]								
Underestimate	24.4	23.0	24.7	27.2	24.3	24.7	29.5	25.6
Close estimate	25.6	29.9[d]	19.3	20.1	18.7	18.1	23.2	23.2
Overestimate	26.8	24.6	27.7	23.9	22.1	21.8	21.8	24.2
Don't know/refused	23.2	22.5	28.3	28.8	34.9	35.4	25.5	27.0
Median	550	550	500	500	500	500	500	500
Cash enlistment bonus[b]								
Yes	33.6	32.6	26.7	27.6	21.2	20.5	23.9	27.2
No	53.7	56.9	59.5	60.3	67.7	66.6	64.0	60.7
Don't know	12.7	10.5	13.8	12.1	11.1	12.9	12.1	12.1
Median	1000	1500	1000	1000	500	500	1200	1000
Educational benefits[c]								
Yes	77.9	70.3[d]	74.6	62.6[d]	66.8	56.6[d]	59.3	68.0
No	19.4	26.1	22.2	32.5	30.1	38.8	35.0	28.1
Don't know	2.7	3.6	3.2	4.9	3.1	4.6	5.7	3.9
Median	10000	10000	10000	10000	10000	8000	8000	10000

SOURCE: Questions 551, 555, 558, 559, 562.

NOTE: Entries are estimated percentages for male respondents ages 16–21 years, based on their predicted probability of scoring in the indicated AFQT categories and their YATS sample weight.

[a]An "overestimate" is $675 or more. An "underestimate" is $475 or less. A "close estimate" is a figure between $476 and $674. Monthly starting pay at the time of the 1985 survey was $573.60. Entries are based on interviews with 5478 respondents: 2127 high school graduates, 883 high school seniors, 1166 younger high school students, and 1302 nongraduates.

[b]Entries are based on interviews with 3158 respondents: 1168 high school graduates, 528 high school seniors, 688 younger high school students, and 774 nongraduates.

[c]Entries are based on interviews with 2320 respondents: 959 high school graduates, 355 high school seniors, 478 younger high school students, and 528 nongraduates.

[d]Difference in rate estimates for category I-IIIA versus category IIIB-V youths within indicated school group is significant at $p < .05$ level.

are reasonably close to the actual value of $575. Respondents were almost as likely to overestimate pay as to underestimate it. Thus, most of the effect of increasing awareness of starting pay would appear to depend on changes in enlistment interest among the "don't know" respondents. Results presented in the 1985 YATS report (Bray et al., 1986) indicate that nearly 70 percent of such persons did not change their stated propensity after being informed of the correct starting pay value, and that those who did changed in both directions.

Knowledge of the availability of cash enlistment bonuses was low for all groups. Overall, 27 percent of the respondents were aware of cash bonuses. Awareness was greatest among high school graduates; about one-third were aware of the bonuses. Awareness among high school seniors was about 5 percentage points lower at 27 percent, and awareness among younger high school students was lowest, at 21 percent. There were no differences in awareness estimates between the AFQT groups; thus, the results suggest that the lower enlistment interest of high aptitude youths is not contributed to by lesser awareness of the enlistment bonus program. However, since awareness of bonuses is so low and, moreover, since those aware of the bonuses seriously underestimate their maximum value—as seen in the median bonus values indicated in the table—greater dissemination of information on the availability of the bonuses and on their cash value might prove useful in recruiting high aptitude youths.[5]

Knowledge of the availability of post-service educational benefits was much more prevalent than knowledge of pay or enlistment bonuses. Overall, some two-thirds of the respondents report awareness of educational benefits. Awareness of the benefits is greatest among high school graduates, next greatest among high school seniors, followed by younger high school students and nongraduates no longer in high school. Awareness of educational benefits is estimated to be significantly greater among category I-IIIA youths than among category IIIB-V youths. For category I-IIIA high school graduates and seniors, the awareness level is estimated at about 75 percent. These results are reassuring; awareness levels are high and do not appear to contribute to the lower enlistment interest of high aptitude youths. However, the data also show that the median educational benefit values estimated by all the groups are well below the true maximum benefit under the new G.I. Bill.[6] Thus, while it may be difficult to increase awareness of post-service educational benefits *per se*, advertising that includes information on the dollar value of the benefits might be beneficial in recruiting high quality youths.

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[5]At the time of the survey, the Army paid a maximum bonus of $8000, the Navy and Marine Corps $5000, and the Air Force $3000.

[6]The 1985 YATS survey was fielded a relatively short time after the new G.I. Bill went into effect; it is possible that knowledge of the benefit's dollar value may have increased since then. Under the new G.I. Bill in 1985, the maximum post-service educational benefit was $25,200.

PREFERRED JOB CHARACTERISTICS AND PERCEIVED AVAILABILITY IN MILITARY VERSUS CIVILIAN JOBS

We now turn to results on the perceived importance of various job characteristics and on the perceived availability of these characteristics in military jobs as compared with civilian jobs. The results are presented in a different format from the preceding tables. Each characteristic was placed into one of four quadrants of a graph, according to its perceived importance and availability. The two **upper** quadrants of each graph contain characteristics that were rated as being relatively **important**; the two lower quadrants contain characteristics that were rated as being less important. The two **right** quadrants of each graph contain characteristics that were rated as being more **available** in military jobs than in civilian jobs; whereas the two left quadrants contain characteristics that were rated as being more available in civilian jobs than in military jobs. This categorization of the characteristics provides the framework illustrated below.

Relatively important and *more available in* civilian jobs	Relatively important and *more available in* military jobs
Less important and more available in civilian jobs	Less important and more available in military jobs

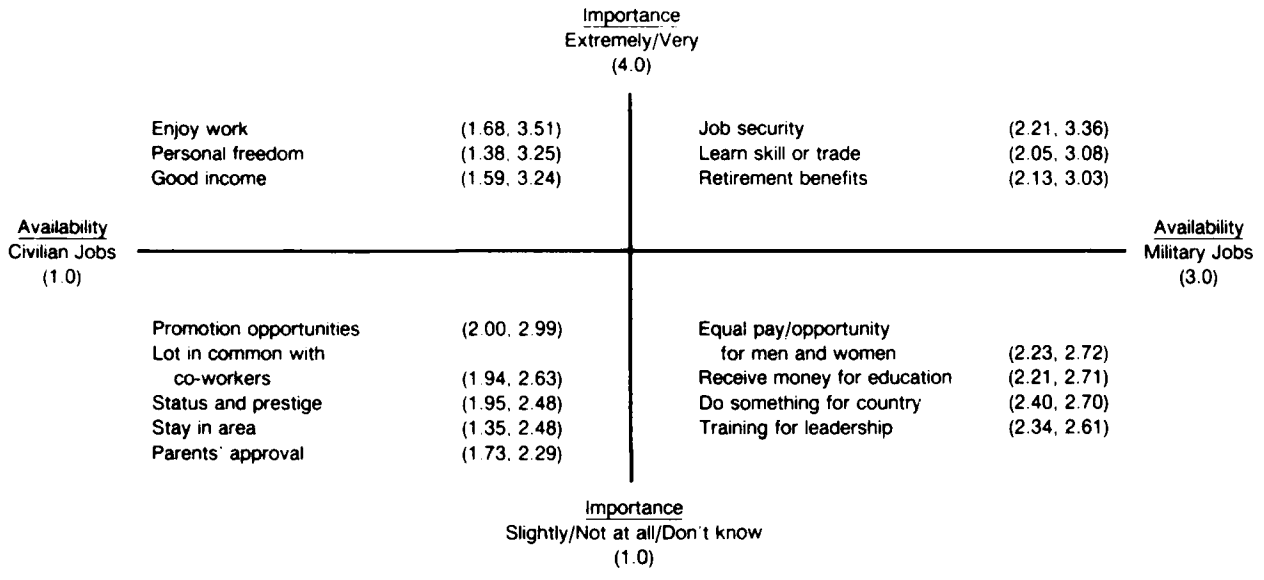
The framework suggests characteristics for which advertising might be helpful and, moreover, provides guidance concerning the type of advertising that would be most beneficial. For example, characteristics in the upper right quadrant are perceived as both important and available in military jobs. For such characteristics, augmentation or redirection of advertising may not be required. In contrast, characteristics in the upper left quadrant are rated as important, but are perceived to be less available in military jobs than in civilian jobs. Where appropriate, advertising for these characteristics could attempt to increase awareness of their availability in the military. Conversely, characteristics in the lower right quadrant are rated as being more available in military jobs than in civilian jobs, but are not rated as

being especially important. Advertising for these characteristics could attempt to increase their perceived importance. Finally, characteristics in the lower left quadrant are not rated as important and, moreover, are perceived to be more available in civilian jobs. Advertising for such characteristics may be both less useful and more difficult.

To create the diagrams, responses to questions concerning the importance of job characteristics were coded as follows: "extremely important" = 4; "very important" = 3; "somewhat important" = 2; "not at all important" = 1; "don't know" = 2.5. Thus, a mean score of 3 or higher for a given high school-AFQT group indicates that on average the members of that group rated the characteristic as being extremely or very important. This was the cutoff point used to place characteristics in the upper quadrants of the graph. Ratings of the perceived availability of the characteristics were coded as follows: "more likely to occur in a military job" = 3; "could occur in either one" or "don't know" = 2; "more likely to occur in a civilian job" = 1. Thus, a mean score greater than 2 for a given group indicates that on average the members of that group rated the characteristic as being more available in a military job than in a civilian job. This was the cutoff point used to place characteristics in the right quadrants of the graph.

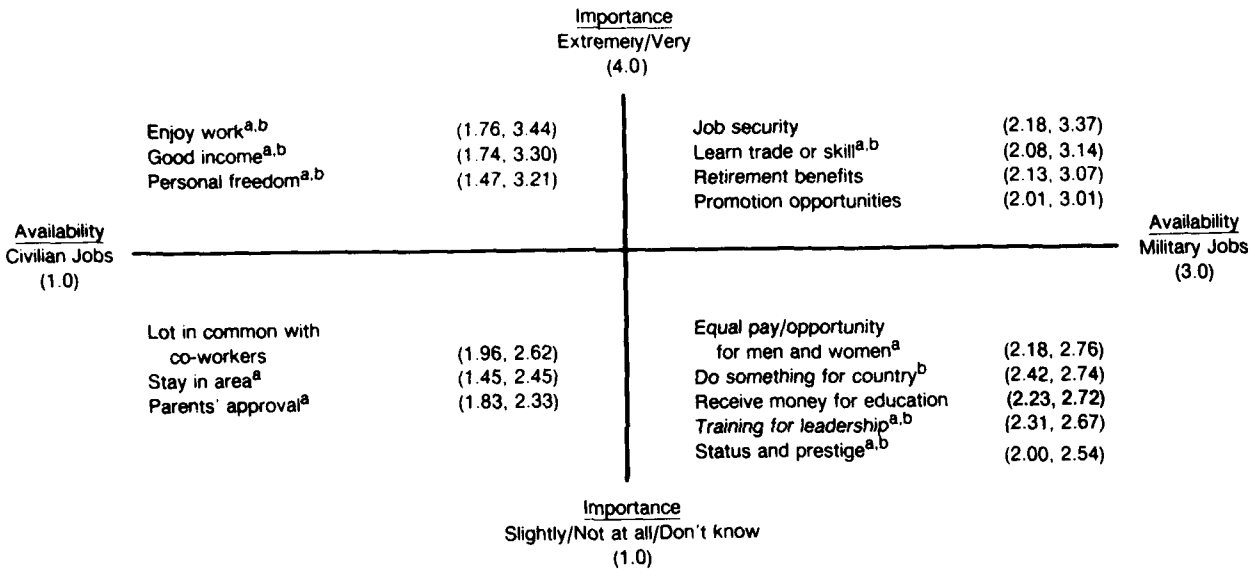
Results are presented for high school graduates and high school students. Because of their similarity, the ratings of seniors and younger high school students were combined. For both high school graduates and high school students, separate graphs are presented based on estimates for AFQT category I-IIIA youths and category IIIB-V youths. Because of their lower recruiting priority, results are not presented for nongraduates. (They closely resemble those for category IIIB-V high school students except, not surprisingly, that receiving money for education was rated as less important.) The diagrams list each characteristic in its appropriate quadrant and indicate its mean availability and importance ratings, in that order. Within each quadrant, the characteristics are listed in order of their perceived importance.

Figure 1 shows estimates for category I-IIIA high school graduates. Results for category IIIB-V graduates are shown in Fig. 2. A comparison of the two reveals that they are very similar. Nearly all the characteristics are located in the same quadrant. The two exceptions—"promotion opportunities" and "status and prestige" also have similar rating estimates for the two AFQT groups. The difference in rating estimates was just enough, however, to locate the characteristic in a different quadrant. Although there are significant differences in some of the rating estimates by AFQT group, the differences are small in absolute terms. For both groups, job security, learning a skill or trade, retirement benefits, and, to a somewhat lesser extent, promotion opportunities are perceived to be



Source is questions 649-678. Characteristics with rounded mean ratings of 2.00 (availability) or 3.00 (importance) were placed in quadrants according to the ratings' true values (N = 2127).

Fig. 1—Preferred job characteristics and perceived availability among category I-IIIA high school graduates



Source is questions 649–678. Characteristics with rounded mean ratings of 2.00 (availability) or 3.00 (importance) were placed in quadrants according to the ratings' true values (N = 2127).

[a]Availability rating estimates for AFQT category I-IIIA (Fig. 1) groups differ significantly at $p < .05$ level.

[b]Importance rating estimates for AFQT category IIIB-V (Fig. 2) differ significantly at $p < .05$ level.

Fig. 2—Preferred job characteristics and perceived availability among category IIIB-V high school graduates

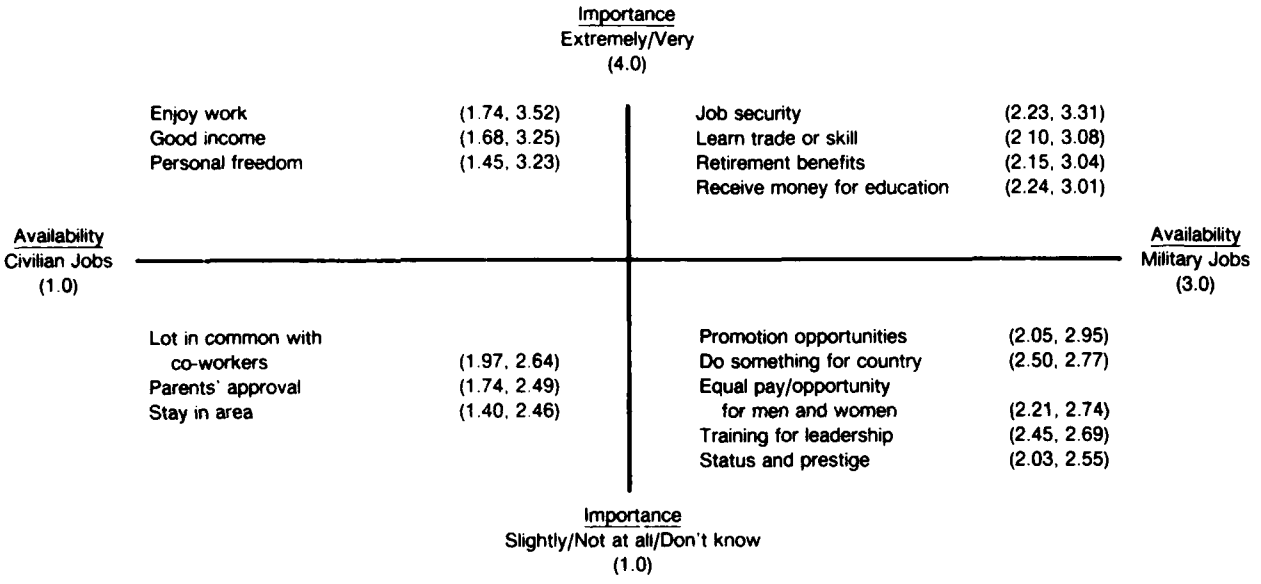
important job characteristics and to be more available in military jobs than in civilian jobs. Special advertising efforts do not appear to be needed for these characteristics for high school graduates. In contrast, enjoying your work, personal freedom, and good income are rated as being important but less available in military jobs than civilian jobs. Where feasible, efforts might be directed at increasing the perceived availability of these characteristics in the military.[7] The characteristics of equal pay and opportunity for men and women, doing something for your country, receiving money for education, being trained for leadership, and to a lesser extent, having status and prestige are rated as being more available in the military but as not being especially important. Advertising for these characteristics might be directed at increasing their perceived importance. Finally, staying in your area, parents' approval, and, to a lesser extent, having a lot in common with your co-workers are rated both as less important and less available in military jobs. Designing advertising for these characteristics may be difficult and have less utility.

Figure 3 gives rating estimates for category I-IIIA high school students. Estimates for category IIIB-V students are shown in Fig. 4. A comparison of the two graphs reveals that they are very similar to each other and, moreover, to the results for high school graduates. Nearly all the characteristics are located in the same quadrant. The one exception—"receive money for education"—is also rated very similarly by the two AFQT groups. The difference in rating estimates was just enough, again, to locate the characteristic in a different quadrant. Although there are significant differences in some of the rating estimates between the AFQT groups, the differences are small in absolute terms. Overall, the two graphs convey the same results. Job security, learning a skill or trade, retirement benefits, and, to a somewhat lesser extent, receiving money for education are perceived to be important job characteristics and to be more available in military jobs than in civilian jobs. Current advertising efforts concerning importance and availability appear to be effective for these characteristics for high school students. In contrast, enjoying your work, personal freedom, and good income are rated as being important but less available in military jobs than civilian jobs. Where feasible, efforts might be directed at increasing the perceived availability of these characteristics in the military. The characteristics of equal pay and opportunity for men and women,

[7]Clearly, such characteristics as personal freedom may be less available in military jobs than in civilian jobs, and thus advertising these characteristics *per se* may not be feasible. However, it may be possible to design advertising that would help counter general perceptions that could adversely affect enlistments. For example, in the case of personal freedom advertising might stress choices that are available to recruits, such as choice of job, length of service, or location of assignment.

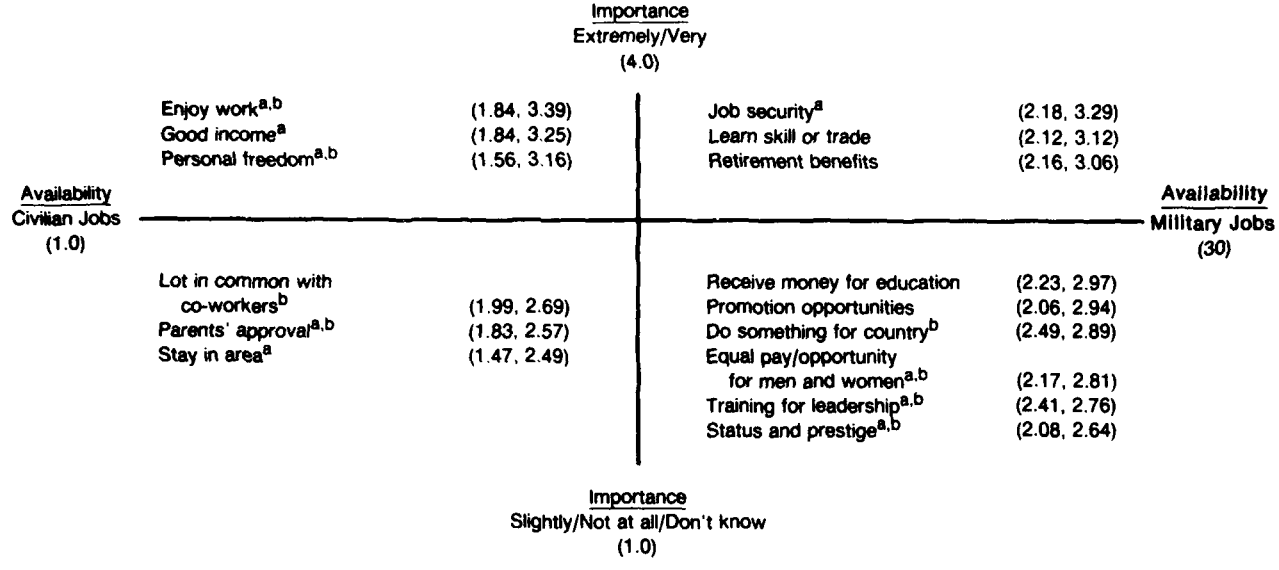
doing something for your country, being trained for leadership, promotion opportunities, and having status and prestige are rated as being more available in the military but as less important. Advertising for these characteristics might be directed at increasing their perceived importance. Finally, staying in your area, parents' approval, and, to a lesser extent, having a lot in common with your co-workers are rated both as less important and less available in military jobs. Designing advertising for these characteristics may be difficult and less useful.

Taken together, the results for high school graduates and high school students provide little evidence of a meaningful difference between the AFQT groups in the relationship between the perceived importance and availability of the job characteristics described above. Moreover, the results for graduates and high school students are very similar. The most notable exception occurs for the characteristic of receiving money for education, which is rated as being more important by those still in high school. This does not mean that money for education is unimportant to graduates. In fact, research by Hosek and Peterson (1985) indicates that among graduates not currently in school, those expecting further education are more likely to enlist than those not expecting further education; in contrast, expectations for more education decrease enlistments among high school seniors. These enlistment results appear generally consistent with the propensity differences noted earlier between persons planning to attend school and those planning to work. Thus, the higher importance rating given to getting money for education as a job characteristic by high school students may mean that both working and going to school are in their future plans. Among graduates, many of those currently in school may not plan to get full-time jobs until they have finished their education; such persons would probably not see obtaining money for education as an important job characteristic. Moreover, as we saw earlier, plans to attend school in the near future are less prevalent among graduates than among high school students. Finally, to the extent that educational benefits increase enlistments, the fact that the graduate sample does not contain high school graduates who enlisted may act to reduce the rated importance of money for education. On the whole, however, the results for graduates and high school students and for AFQT categories I-IIIA and categories IIIB-V are very similar. This suggests that advertising that is effective in increasing enlistment interest for one group will also tend to increase interest for the other groups.



Source is questions 649–678. Characteristics with rounded mean ratings of 2.00 (availability) or 3.00 (importance) were placed in quadrants according to the ratings' true values (N = 2049).

Fig. 3—Preferred job characteristics and perceived availability among category I-IIIA high school students



Source is questions 649-678. Characteristics with rounded mean ratings of 2.00 (availability) or 3.00 (importance) were placed in quadrants according to the ratings' true values (N = 2049).

[a]Availability rating estimates for AFQT category I-IIIA (Fig. 1) groups differ significantly at $p < .05$ level.

[b]*Importance rating estimates for AFQT category IIIB-V (Fig. 2) differ significantly at* $p < .05$ level.

Fig. 4—Preferred job characteristics and perceived availability among category IIIB-V high school students

V. CONCLUSIONS AND IMPLICATIONS

As part of the recruiting effort, the Department of Defense regularly sponsors surveys of the national youth population. The purpose of such surveys is to provide information that can be used in designing recruiting and advertising strategies. However, given the military's interest in recruiting high quality youths—i.e., high school diploma graduates who score at or above the 50th percentile (categories I-IIIA) on the Armed Forces Qualification Test (AFQT)—most of the surveys have an important shortcoming: they do not identify the AFQT scores of the respondents. As a consequence, researchers are unable to focus their analyses of the survey data on the subgroup of primary interest. This report addresses that shortcoming by presenting and applying a method of using the information contained in national youth surveys to estimate the probability that respondents would score in categories I-IIIA if they took the AFQT. We have illustrated the application of the method in estimating and comparing results for high versus low aptitude respondents on factors such as background characteristics, enlistment propensity, future plans, recruiter contacts, and awareness of military advertising and enlistment incentives, and to examine the interrelationships of these factors. In this final section, we review the AFQT category estimation method and the results. We then present two additional applications: the use of the method in estimating the proportion of high aptitude youths in the surveyed population and in exploring results of special interest to provide policy guidance.

REVIEW

Development of Method

We developed a quality-based analysis capability for the Youth Attitude Tracking Study (YATS)—the primary recruiting-related survey sponsored on an ongoing basis by the Department of Defense—and applied it to selected results from the 1985 YATS survey. However, the method is applicable to all surveys of the national youth population similar to the YATS that provide appropriate respondent background information. Because of the services' interest in recruiting AFQT category I-IIIA youths, we developed models to estimate the probability that an individual would score at or above the 50th percentile on the AFQT if he took the test. Separate models were constructed for high

school students and individuals no longer in high school, because previous research has shown that high school students and persons no longer in high school differ in fundamental ways in enlistment decisionmaking. Finally, we employed a two-equation, maximum likelihood estimation procedure that accounts for an individual's probability of taking the written test (AFQT) and the correlation between the error terms in the testing and high AFQT equations, to deal with the potential selectivity bias that could be introduced by simply modeling the AFQT scores of the 20 percent of young men who test. Such persons differ in systematic ways from those who do not take the AFQT.

Two types of analyses were conducted to assess the accuracy and reliability of the estimation procedure. Both involved comparisons of predicted AFQT values with the actual results of persons who tested. One analysis compared the proportion of AFQT-takers actually scoring in categories I-IIIA with the test-takers' predicted probability of doing so. The second compared the actual and predicted characteristics of category I-IIIA test-takers. Each analysis was made for two datasets. To check the method's accuracy, we analyzed results from the survey waves used to construct the equations (fall 1976–1980). To assess its reliability, we analyzed results from the spring 1976–1980 YATS surveys. The analyses show that the AFQT estimation method produces accurate and reliable results. Test-takers' predicted probabilities of scoring in categories I-IIIA are in close agreement with their actual test results, for both the high school student and non-high school student models and for both the fall (original) and spring survey waves. The predicted and actual background characteristics of category I-IIIA test-takers—such as region of residence and employment status—also correspond closely.

AFQT-Based Analysis of the 1985 YATS Survey

To illustrate a key application of this approach in providing information of potential use in targeting recruiting and advertising efforts, we used it to analyze data provided by young male respondents to the 1985 YATS survey. In light of known differences in recruiting policy and behavior, the results were analyzed for four major groups according to high school status: (1) high school diploma graduates; (2) high school seniors; (3) younger high school students; and (4) nongraduates, i.e., individuals without high school diplomas who were not continuing in high school. Results for each of the graduate and student groups were estimated for two subgroups: AFQT category I-IIIA and AFQT category IIIB-V. Because of its lower recruiting priority, the nongraduate group's results were not analyzed by subgroup.

The analysis showed large differences in stated enlistment propensity levels among the school groups and between the aptitude subgroup estimates. Propensity to enlist was much greater for high school students than for high school graduates. Overall, about 35–40 percent of the students reported positive propensity, compared to just under 20 percent of the graduates. Also, enlistment propensity was estimated to be much lower for AFQT category I-IIIA youths than for category IIIB-V youths. Positive propensity estimates for category I-IIIA high school students were nearly 15–20 percentage points lower than for category IIIB-V students; the corresponding difference among high school graduates was nearly 15 percentage points. Differences in stated enlistment propensity were reflected in the rates of taking actions toward enlistment: in general, lower AFQT youths appear to be more likely than higher AFQT youths to take such actions. However, differences between the AFQT groups were not large in absolute terms, never exceeding 5 percentage points.

The military appears to compete with full-time school attendance for the majority of category I-IIIA youths. For lower aptitude youths, the opportunity to recruit from the school and labor markets appears more balanced. Encouragingly, among high school graduates, category I-IIIA youths planning to attend school full-time in the future appear to have comparable enlistment propensity to those planning to work full-time. Among high school students, however, they have lower propensity.

Considering all services and media together, there was high awareness of recent advertising for the military. Some 80–90 percent of the respondents recalled seeing or hearing broadcast advertising for the military during the past year. Awareness of print advertising was 5–10 percentage points lower, whereas reports of receiving unsolicited recruiting literature were less common. The three media combined appeared to cover about 95 percent of the market with military advertising. Media coverage for the individual services and components varied considerably and was much lower overall; coverage estimates for the individual service-media pairs generally averaged 50 percent or less of the high aptitude markets. The results are reassuring in suggesting that as many AFQT category I-IIIA youths as category IIIB-V youths were reached by advertising efforts. However, large proportions of category I-IIIA youths appeared to be unaware of recent advertising for most services, particularly if the media are considered individually. As a result, attempts to increase market coverage among high aptitude youths could prove beneficial in recruiting efforts. Such campaigns could limit required resource expenditures by concentrating on the most cost-effective media (see Dertouzos, Polich, Bamezai, and Chestnutt, forthcoming).

Only 25 percent of the respondents could closely estimate military starting pay. However, the data provide little evidence of differential knowledge of pay by AFQT group or that increasing awareness of pay would increase enlistment interest. Similarly, only 27 percent of the respondents were aware of enlistment bonuses, and they seriously underestimated the bonuses' cash value. There was little evidence of differential awareness by AFQT group. Given the uniformly low awareness level and the demonstrated effects of bonuses on recruiting efforts (see Polich, Dertouzos, and Press, 1986), advertising the availability of enlistment bonuses and their cash value might be beneficial. Awareness of educational benefits was much greater. Two-thirds of the respondents overall and 75 percent of category I-IIIA high school graduates and seniors appeared to be aware of the post-service educational benefit program. However, the maximum value of the benefit was underestimated considerably. The results suggest that advertising that includes information on the benefit's dollar value might be beneficial. (See Fernandez, 1982, for an analysis of the market expansion effects of post-service educational benefits.)

Various job characteristics assessed in the YATS were analyzed according to their perceived importance and availability in military versus civilian jobs. Results for all the school-AFQT groups were similar. Job security, learning a skill or trade, retirement benefits, and, to a lesser extent, getting money for education and promotion opportunities were perceived to be both important and more available in military jobs. The analysis also suggests that, where feasible, advertising might be directed at increasing the perceived **availability** of enjoying your work, personal freedom, and good income in military jobs. Advertising efforts might be directed at increasing the perceived **importance** of equal pay and opportunity for men and women, doing something for your country, being trained for leadership, and having status and prestige. Finally, having a lot in common with co-workers, staying in your area, and parents' approval were rated as both less available in military jobs and not especially important. Advertising for these characteristics may be more difficult and less useful.

ADDITIONAL APPLICATIONS

Estimating the Proportion of AFQT Category I-IIIA Youth

A second application of the technique developed in this report is the estimation of the proportion of AFQT category I-IIIA youth in the surveyed population or in subgroups of special interest. The computation of such estimates is straightforward. For each individual in the

relevant group, the technique predicts the probability that he would score in categories I-IIIA if he took the AFQT. Thus, the mean of the predicted probabilities for the persons in the group—weighted by any applicable sample weights—equals the estimated proportion of category I-IIIA members. The estimated number of such persons is simply the number of persons in the sampled population who belong to the group times the estimated proportion of category I-IIIA members. Care should be exercised when using such estimates, because their confidence intervals are larger than those applying to the types of data summaries presented in this report. (The variance of such estimates is discussed in the Appendix.)

Exploration of Results for Category I-IIIA Youth

Another important use of the AFQT category estimation technique is the in-depth exploration of specific results for high aptitude youth. To place this work in context, recall that the analysis of the 1985 YATS data reported in Sec. IV indicated that category I-IIIA youth had less interest in enlisting than category IIIB-V youth. It also suggested that this lesser interest is **not** attributable to lower levels of awareness of military advertising or enlistment incentive programs; where differences exist, awareness levels appear to be greater among category I-IIIA youth. However, the results indicate that substantial proportions of high aptitude youth were unaware of advertising for the individual services and components or of the enlistment incentive packages offered by the services. Given the usefulness of advertising and of enlistment incentive programs such as enlistment bonuses and post-service educational benefits in meeting recruiting objectives (see Fernandez, 1982; Polich, Dertouzos, and Press, 1986; Dertouzos et al., forthcoming), we suggested that increased advertising market coverage and the dissemination of information on enlistment incentive programs might be helpful in recruiting category I-IIIA youths. Here, we wish to examine the relationship between (1) recall of the individual advertising media and recent recruiter contacts and (2) awareness of the enlistment incentive programs. Our goal is to show how this approach can provide guidance for future policy decisions by examining whether some recruiting resources may be more effective than others in conveying information about the incentive programs. Because service advertising and recruiting policies differ and because much of the data on enlistment incentive and advertising effectiveness in the cited studies concern Army programs, our example will apply to the U.S. Army.

Table 15 shows estimated awareness levels of the Army's enlistment bonus program among category I-IIIA youth, according to education status, and the estimated change in awareness levels associated with

Table 15

AWARENESS OF ARMY ENLISTMENT BONUS PROGRAM BY RECRUITING RESOURCE AMONG AFQT CATEGORY I-IIIA YOUTH

Recruiting Resource	Estimated Percentage Aware of Bonus Program: High School Graduates (N = 1168)	High School Seniors (N = 528)	Younger High School Students (N = 688)
Broadcast advertising (proportion recalling)	17.4 (.537)	8.0 (.566)	8.9 (.549)
Print advertising (proportion recalling)	22.6[a] (.491)	14.8 (.564)	16.0[b] (.472)
Recruiting literature (proportion receiving)	16.5 (.412)	20.1[a] (.410)	29.3[a] (.108)
Recent recruiter contact (proportion reporting)	32.7[a] (.105)	18.3[a] (.148)	21.4 (.035)
None of the above resources (proportion reporting no recall/receipt/contact)	16.9 (.191)	10.8 (.133)	11.2 (.250)

[a] $p < .05$.
[b] $p < .10$.

Table 16

AWARENESS OF ARMY EDUCATIONAL BENEFIT PROGRAM BY RECRUITING RESOURCE AMONG AFQT CATEGORY I-IIIA YOUTH

Recruiting Resource	Estimated Percentage Aware of Educational Benefit Program: High School Graduates (N = 959)	High School Seniors (N = 355)	Younger High School Students (N = 478)
Broadcast advertising (proportion recalling)	62.0 (.541)	54.4 (.517)	42.3 (.521)
Print advertising (proportion recalling)	64.9[b] (.505)	58.0 (.535)	59.0[a] (.505)
Recruiting literature (proportion receiving)	61.8 (.409)	67.8[a] (.475)	44.8 (.102)
Recent recruiter contact (proportion reporting)	70.7[a] (.116)	82.2[a] (.129)	69.2[a] (.066)
None of the above resources (proportion reporting no recall/receipt/contact)	58.7 (.198)	55.0 (.156)	38.0 (.265)

[a] $p < .05$.
[b] $p < .10$.

recall of individual Army advertising media or recent contact with an Army recruiter. The estimated awareness level among the members of each education group who report no recall of Army broadcast or print advertising, no receipt of recruiting literature, and no recent contact with an Army recruiter are shown in the bottom row. The rates presented in the first four rows of the table for each resource indicate how the estimated awareness level of the Army enlistment bonus program among category I-IIIA youths changes if the youths were reached by the indicated resource. For example, among category I-IIIA graduates who report no recall of recent Army broadcast or print advertising, no receipt of mailed Army recruiting literature, and no recent contacts with Army recruiters, the estimated awareness level of the Army's enlistment bonus program is 16.9 percent. In contrast, among persons who had recent recruiter contacts, but were not reached by the three other resources, the estimated awareness level is 32.7 percent. The figures in parentheses below each percentage indicate the proportion of the group reached by the indicated resource. Table 16 presents the corresponding results concerning awareness of the Army's post-service educational benefit program. The data are derived from logistic regression analyses; the coefficients obtained in these analyses are presented in the Appendix. The results should be interpreted with caution, because the overall explanatory power of the models, although statistically significant, is small in absolute terms.

The regression results for the two incentive programs are consistent and suggestive. In both cases, recall of broadcast advertising did not increase program awareness significantly for any of the education groups. In contrast, recent contact with an Army recruiter increased estimated awareness levels substantially.[1] The results for the two remaining resources—print advertising and mailed recruiting literature—varied with education status. Recall of print advertising was associated with higher estimated awareness levels for both programs to a significant or near-significant extent among high school graduates and younger high school students; among seniors, the estimated increase in program awareness did not approach statistical significance. In contrast, receipt of recruiting literature was most consistently

[1]The effects for recent contacts with Army recruiters could also reflect an increased probability of initiating such contacts among persons aware of the incentive programs. It is impossible to disentangle these effects with the available YATS data. However, given the magnitude of the recruiter contact coefficients and the results concerning the market expansion effects of the incentive programs presented in the reports cited earlier, the evidence appears to support an information dissemination interpretation. It should be noted also that the one failure of the recruiter contact effect to reach statistical significance—bonus awareness among younger high school students—is attributable in part to the very low recruiter contact rate among such individuals.

associated with increased program awareness among high school seniors. One of the two effects—awareness of the bonus—was significant for younger students, whereas there was little impact on estimated program awareness levels among graduates. The pattern of these results is reasonable, given that the Army mails most literature during students' senior year in high school. Considerable time had passed for many graduates since they received recruiting literature, and we might expect recall of the details in the literature to have diminished during this period; in contrast, seniors would have received such literature recently, and thus should recall most of what they absorbed from it. For this reason, the literature effect for seniors provides a better comparison with the results for other resources, which capture recent exposures.

These results suggest that print advertising and mailed recruiting literature are effective methods of disseminating information about enlistment incentive programs among the high quality military available population, and should be considered in efforts to increase market coverage. Although estimated program awareness levels also rise significantly with recent recruiter contacts, such contacts are made by a much smaller proportion of the population than is exposed to the advertising media, as seen in Tables 15 and 16. On balance, the results fit nicely with recent work reported by Dertouzos et al. (forthcoming) on the impact of Army advertising. They conclude that print advertising is more cost-effective than broadcast advertising or recruiter resources in promoting high quality enlistments.

Appendix

SUPPLEMENTAL INFORMATION

SAS CODE FOR VARIABLES IN AFQT ESTIMATION EQUATIONS

Tables A.1–A.3 provide information pertaining to the SAS code used to define the factors in the AFQT category estimation procedure. The question numbers refer to the 1985 YATS survey instrument. We begin with a listing of matched factor names (from Tables 1 and 2) and variable names (from the SAS computer coding) in Tables A.1 and A.2. Table A.3 provides the SAS computer coding.

SUPPLEMENTAL INFORMATION FOR MEN'S AFQT ANALYSIS

Tables A.4 and A.5 provide the means and standard deviations of the variables used in the men's AFQT estimation procedure. The information pertains to the fall 1976–fall 1980 YATS waves. Tables A.6 and A.7 compare the actual and predicted characteristics of category I-IIIA AFQT-takers. Table A.6 supplements the characteristics listed in Table 5 (fall 1976–1980 waves). Table A.7 provides supplemental information for Table 6 (spring 1976–1980 waves).

AFQT ANALYSIS INFORMATION FOR WOMEN

Tables A.8 and A.9 indicate the parameter estimates for the women's AFQT estimation equations (fall 1980–1981 waves). The means and standard deviations of the variables in the AFQT models are given in Tables A.10 and A.11 for high school students and women no longer in high school, respectively. The accuracy of the models is assessed in Tables A.12 and A.13. Table A.12 compares the predicted probability of scoring in categories I-IIIA with the proportion of female AFQT-takers actually scoring at or above the 50th percentile. Because of the much smaller number of cases as compared to male respondents, the comparison is made for three probability groupings instead of ten. In Table A.13, the actual and estimated percentage distributions for category I-IIIA female test-takers are compared on a variety of background characteristics.

Table A.1

VARIABLE NAMES FOR RESPONDENTS IN HIGH SCHOOL (INHISCOL = 1)

Factor Name	SAS Code Name
I. TEST EQUATION ($\alpha_1 + \beta_1 X_1$)	
Background characteristics	
Race (vs. white, non-Hispanic)	
Black	RACEBLK
Other nonwhite	RACENW
Resides in the South	SOUTH
Economic factors	
Perceived ease of finding full-time employment	DIFFFULN
Educational experience	
Senior (vs. sophomore or junior)	SENIOR
Grade-point average	GPA
Courses completed in high school	
Elementary algebra	ALGELE
Geometry	GEO
Intermediate algebra	ALGINT
Trigonometry	TRIN
Military interest	
Intention to enlist (vs. negative)	
Very positive	PROPEN1
Somewhat positive	PROPEN2
Had recruiter contact	EVERRECN
Talked to parents about enlisting	TLKPRNT2
II. HIGH AFQT EQUATION ($\alpha_2 + \beta_2 X_2$)	
Background characteristics	
Race (vs. white, non-Hispanic)	
Black	RACEBLK
Other nonwhite	RACENW
Age 16 or 17 (vs. 18)	AGE1617
Resides in the South	SOUTH
Father's education	DADSED2
Educational experience	
Senior (vs. sophomore or junior)	SENIOR
Grade-point average	GPA
Courses completed in high school	
Elementary algebra	ALGELE
Geometry	GEO
Intermediate algebra	ALGINT
Trigonometry	TRIN
Military interest	
Intends to enlist (vs. negative)	PROPDUM

Table A.2

VARIABLE NAMES FOR RESPONDENTS NOT IN HIGH SCHOOL
(INHISCOL = 0)

Factor Name	SAS Code Name
I. TEST EQUATION $(\alpha_1 + \beta_1 X_1)$	
Background characteristics	
Race (vs. white, non-Hispanic)	
Black	RACEBLK
Other nonwhite	RACENW
Age (vs. 16–18)	
Age 19	AGE19
Age 20	AGE20
Age 21	AGE21
Resides in the South	SOUTH
Economic factors	
Current job status (vs. employed full-time and not attending college)	
Employed part-time, not attending college	EMPLPARA
Looking for work, not attending college	LOOKINNA
Out of labor force, not attending college	OLFA
Employed full-time, attending college	EMPLFULB
Employed part-time, attending college	EMPLPARB
Looking for work, attending college	LOOKINNB
Out of labor force, attending college	OLFB
Perceived ease of finding full-time employment	DIFFFULN
Educational experience	
High school dropout	DROPOUT
Military interest	
Intention to enlist (vs. negative)	
Very positive	PROPEN1
Somewhat positive	PROPEN2
Had recruiter contact	EVERRECN
Talked to parents about enlisting	TLKPRNT2

Table A.2—continued

Factor Name	SAS Code Name
II. HIGH AFQT EQUATION ($\alpha_2 + \beta_2 X_2$)	
Background characteristics	
Race (vs. white, non-Hispanic)	
Black	RACEBLK
Other nonwhite	RACENW
Resides in the South	SOUTH
Father's education	DADSED2
Economic factors	
Employed full-time, not attending college	EMPLFULA
Employed part-time, not attending college	EMPLPARA
Educational experience	
Current status (vs. high school graduate not attending college)	
Attending college	INCOL
Attending college, employed full-time	EMPLFULB
High school dropout	DROPOUT
High school grade-point average	GPA
Courses completed in high school	
Elementary algebra	ALGELE
Geometry	GEO
Intermediate algebra	ALGINT
Trigonometry	TRIN
Military interest	
Intends to enlist (vs. negative)	PROPDUM

Table A.3

SAS COMPUTER CODING FOR AFQT ESTIMATION PROCEDURE

```
 1.   IF Q406=1 THEN HSGRAD2=1;  ELSE HSGRAD2=0;
 2.   IF HSGRAD2=0 AND Q408=3 THEN INHISCOL=1;  ELSE INHISCOL=0;
 3.   IF 1<=Q700<=2 THEN GPA=1;  ELSE IF 3<=Q700<=4 THEN GPA=2;  ELSE
 4.   IF 5<=Q700<=6 THEN GPA=3;  ELSE IF Q700=7 THEN GPA=4;  ELSE
 5.   GPA=3;
 6.   GPA=5-GPA;   IF GPA=1 THEN GPA=2; ELSE GPA=GPA;
 7.   IF 1<=Q713F<=11 THEN DADSED2=1;
 8.   ELSE IF 12=Q713F THEN DADSED2=2;
 9.   ELSE IF 12<=Q713F<=15 THEN DADSED2=3;
10.   ELSE IF 16<=Q713F<=20 THEN DADSED2=4;
11.   ELSE DADSED2=2;
12.
13.    IF Q702=1 THEN ALGELE=1;
14.   ELSE ALGELE=0;
15.
16.   IF Q706=1 THEN ALGINT=1;
17.   ELSE ALGINT=0;
18.
19.   IF Q703=1 THEN GEO=1;
20.   ELSE GEO=0;
21.
22.    IF Q707=1 THEN TRIN=1;
23.   ELSE TRIN=0;
24.
25.   IF 9<=Q408<=10 THEN INCOL=1;
26.   ELSE INCOL=0;
27.   IF INHISCOL=1 AND Q404=9 THEN SOPH=1;  ELSE SOPH=0;
28.   IF INHISCOL=1 AND Q404=10 THEN JUNIOR=1;  ELSE JUNIOR=0;
29.   IF INHISCOL=1 AND Q404=11 THEN SENIOR=1;  ELSE SENIOR=0;
30.   IF Q403=16 THEN AGE16=1;  ELSE AGE16=0;
31.   IF Q403=17 THEN AGE17=1;  ELSE AGE17=0;
32.   IF Q403=18 THEN AGE18=1;  ELSE AGE18=0;
33.   IF Q403=19 THEN AGE19=1;  ELSE AGE19=0;
34.   IF Q403=20 THEN AGE20=1;  ELSE AGE20=0;
35.   IF Q403=21 THEN AGE21=1;  ELSE AGE21=0;
36.   IF 19<=Q403<=21 THEN AGE19P=1;  ELSE AGE19P=0;
37.   IF 16<=Q403<=17 THEN AGE1617=1; ELSE AGE1617=0;
38.
39.
40.
41.   IF Q714=2 AND Q715 NE 1 THEN RACEBLK=1;
42.   ELSE RACEBLK=0;
43.   IF 3<=Q714<=4 THEN RACENW=1;  ELSE IF Q715=1 THEN RACENW=1;
44.   ELSE RACENW=0;
45.   RACEMIN=RACEBLK+RACENW;
46.   STATE=STFIPS2;
47.    IF STATE= 9 OR STATE=23 OR STATE=25 OR STATE=33 OR STATE=34 OR
48.       STATE=36 OR STATE=42 OR STATE=44 OR STATE=50
49.       THEN DIST= 1 ;
50.    IF STATE=17 OR STATE=18 OR STATE=19 OR STATE=20 OR STATE=26 OR
51.       STATE=27 OR STATE=29 OR STATE=31 OR STATE=38 OR STATE=39 OR
52.       STATE=46 OR STATE=55 THEN DIST= 2 ;
53.    IF STATE= 1 OR STATE= 5 OR STATE=10 OR STATE=11 OR STATE=12 OR
54.       STATE=13 OR STATE=21 OR STATE=22 OR STATE=24 OR STATE=28 OR
55.       STATE=37 OR STATE=40 OR STATE=45 OR STATE=47 OR STATE=48 OR
56.       STATE=51 OR STATE=54 THEN DIST= 3 ;
57.    IF STATE= 2 OR STATE= 4 OR STATE= 6 OR STATE= 8 OR STATE=15 OR
58.       STATE=16 OR STATE=30 OR STATE=32 OR STATE=35 OR STATE=49 OR
59.   STATE=41 OR STATE=53 OR STATE=56 THEN DIST=4 ;
60.    IF STATE= 3 OR STATE= 7 OR STATE=14 OR STATE=40 OR STATE=52
```

Table A.3—continued

```
61.          THEN DIST= 5 ;
62.
63.       IF 1<=DIST<=4 ;
64.       EAST=0 ; NCENT=0 ; SOUTH=0 ; WEST=0;
65.       IF DIST=1 THEN EAST=1 ;
66.       ELSE IF DIST=2 THEN NCENT=1 ;
67.       ELSE IF DIST=3 THEN SOUTH=1 ;
68.      ELSE IF DIST>3 THEN WEST=1;
69.      IF V438JOIN=1 AND Q441=1 AND (1<=Q440<=2 OR 4<=Q440<=5) THEN
70.        UNAIDED=1; ELSE UNAIDED=0;
71.      IF 1<=Q503<=2 AND UNAIDED=1 THEN COMBACT=1; ELSE
72.      IF 1<=Q503<=2 AND UNAIDED=0 THEN COMBACT=2; ELSE
73.      IF 3<=Q503<=8 THEN COMBACT=3; ELSE COMBACT=3;
74.      IF COMBACT=1 THEN PROPEN1=1; ELSE PROPEN1=0;
75.      IF COMBACT=2 THEN PROPEN2=1; ELSE PROPEN2=0;
76.      PROPDUM=PROPEN1+PROPEN2;
77.      IF Q416=1 AND (1<=Q424<35) THEN EMSTAT=1;  ELSE
78.      IF Q416=1 AND (35<=Q424<98) THEN EMSTAT=2;  ELSE
79.      IF Q416 NE 1 AND Q417=1 THEN EMSTAT=3;  ELSE
80.      IF Q416 NE 1 AND (Q417=2 OR Q417=9) THEN EMSTAT=4;
81.      IF EMSTAT=1 THEN EMPLPART=1; ELSE EMPLPART=0;
82.      IF EMSTAT=2 THEN EMPLFULL=1; ELSE EMPLFULL=0;
83.      IF EMSTAT=3 THEN LOOKINN=1; ELSE LOOKINN=0;
84.      IF EMPLPART=0 AND EMPLFULL=0 AND LOOKINN=0 THEN OLFALL=1;
85.       ELSE OLFALL=0;
86.      IF Q628=1 THEN EVERRECN=1; ELSE EVERRECN=0;
87.
88.
89.      IF Q436=98 THEN DIFFFULN=2.5; ELSE DIFFFULN=Q436;
90.      IF V684MOM=1 OR V684DAD=1 THEN TLKPRNT2=1; ELSE TLKPRNT2=0;
91.      IF INCOL=0 AND EMPLFULL=1 THEN EMPLFULA=1; ELSE EMPLFULA=0;
92.      IF INCOL=0 AND EMPLPART=1 THEN EMPLPARA=1; ELSE EMPLPARA=0;
93.      IF INCOL=0 AND LOOKINN=1 THEN LOOKINNA=1; ELSE LOOKINNA=0;
94.      IF INCOL=0 AND EMPLFULL=0 AND EMPLPART=0 AND LOOKINN=0
95.        THEN OLFA=1; ELSE OLFA=0;
96.      IF INCOL=1 AND EMPLFULL=1 THEN EMPLFULB=1; ELSE EMPLFULB=0;
97.      IF INCOL=1 AND EMPLPART=1 THEN EMPLPARB=1; ELSE EMPLPARB=0;
98.      IF INCOL=1 AND LOOKINN=1 THEN LOOKINNB=1; ELSE LOOKINNB=0;
99.      IF INCOL=1 AND EMPLFULL=0 AND EMPLPART=0 AND LOOKINN=0
100.       THEN OLFB=1; ELSE OLFB=0;
101.     EMPLOYA=EMPLFULA+EMPLPARA;
102.
103.     IF HSGRAD2=1 THEN DROPOUT=0; ELSE
104.     IF INHISCOL=1 THEN DROPOUT=0; ELSE    DROPOUT=1;
105.
106.     IF  INHISCOL=1 THEN   DO;
107.          XBETA1    =( -.50552641      )+
108.          GPA       *( -.13124318      )+
109.          ALGELE    *( -.36711644D-01  )+
110.          ALGINT    *( -.14373497      )+
111.          GEO       *( -.79664138D-01  )+
112.          TRIN      *( -.17965983      )+
113.          RACEBLK   *(  .37385956      )+
114.          RACENW    *( -.31112383D-01  )+
115.          PROPEN1   *(  1.0250457      )+
116.          PROPEN2   *(  .39991063      )+
117.          SENIOR    *( -.68545405D-01  )+
118.          TLKPRNT2  *(  .34776031      )+
119.          EVERRECN  *(  .17722719      )+
120.          DIFFFULN  *( -.49336698D-01  )+
121.          SOUTH     *( -.15796351D-01  );
```

Table A.3—continued

```
            XBETA2    =( -1.7071034       )+
            GPA       *(  .20845941       )+
            ALGELE    *(  .30654705       )+
            ALGINT    *(  .28051052       )+
            GEO       *(  .55917821       )+
            TRIN      *(  .33289030       )+
            DADSED2   *(  .90448260D-01   )+
            RACEBLK   *( -1.0334975       )+
            RACENW    *( -.43733932       )+
            AGE1617   *(  .54687652       )+
            SENIOR    *(  .22742748       )+
            PROPDUM   *( -.25688671       )+
            SOUTH     *( -.22411308       );
            RHO       =(  .37837200D-01   );

      END;
      IF   INHISCOL=0 THEN DO;
            XBETA1=     ( -1.4095151      )+
            AGE19     *( -.91969103D-01   )+
            AGE20     *( -.13803308       )+
            AGE21     *( -.18797315       )+
            RACEBLK   *(  .39870794       )+
            RACENW    *(  .20319308       )+
            PROPEN1   *(  .73947345       )+
            EVERRECN  *(  .37637342       )+
            DIFFFULN  *( -.33886643D-01   )+
            EMPLPARA  *(  .91017261D-01   )+
            LOOKINNA  *(  .23814651       )+
            OLFA      *(  .11637758       )+
            EMPLFULB  *(  .37318635D-01   )+
            EMPLPARB  *( -.10983062       )+
            LOOKINNB  *( -.74154264D-01   )+
            OLFB      *( -.36693248       )+
            DROPOUT   *(  .13280864       )+
            SOUTH     *( -.46114023D-01   )+
            TLKPRNT2  *(  .41220313       )+
            PROPEN2   *(  .27461603       );
            XBETA2=     ( -1.2284635      )+
            GPA       *(  .28173034       )+
            ALGELE    *(  .29476118       )+
            ALGINT    *(  .15952046       )+
            GEO       *(  .27499241       )+
            TRIN      *(  .29614190       )+
            DADSED2   *(  .12803229       )+
            RACEBLK   *( -1.1872787       )+
            RACENW    *( -.79989131       )+
            INCOL     *(  .35273868       )+
            PROPDUM   *( -.34715900       )+
            EMPLFULA  *( -.61640931D-01   )+
            EMPLPARA  *(  .84977633D-01   )+
            EMPLFULB  *( -.49035648       )+
            DROPOUT   *( -.36296814       )+
            SOUTH     *( -.90708108D-01   );
            RHO       =( -.47919100D-01   );
       END;
      PFULSAMP=PROBNORM(XBETA2);
       P1=PROBNORM(-XBETA1) ;
       P2=BIVNOR(XBETA1,-XBETA2,-RHO) ;
       P3=BIVNOR(XBETA1,XBETA2,RHO) ;
      PTEBTKRS=P3/(P2+P3);
```

Table A.4

SUPPLEMENTAL VARIABLE INFORMATION
FOR RESPONDENTS IN HIGH SCHOOL

Variable	Mean	Standard Deviation
I. TEST EQUATION $(\alpha_1 + \beta_1 X_1)$ [a]		
Background characteristics		
Race (vs. white, non-Hispanic)		
Black	.123	.329
Other nonwhite	.054	.226
Resides in the South	.372	.483
Economic factors		
Perceived ease of finding full-time employment [b]	2.667	.893
Educational experience		
Senior (vs. sophomore or junior)	.459	.498
Grade-point average [c]	3.152	.680
Courses completed in high school		
Elementary algebra	.692	.462
Geometry	.483	.500
Intermediate algebra	.432	.495
Trigonometry	.182	.386
Military interest		
Intention to enlist (vs. negative) [d]		
Very positive	.073	.260
Somewhat positive	.288	.453
Had recruiter contact	.432	.495
Talked to parents about enlisting	.444	.497

Table A.4—continued

Variable	Mean	Standard Deviation
II. HIGH AFQT EQUATION ($\alpha_2 + \beta_2 X_2$) [a]		
Background characteristics		
Race (vs. white, non-Hispanic)		
Black	.205	.404
Other nonwhite	.056	.231
Age 16 or 17 (vs. 18)	.870	.337
Resides in the South	.399	.490
Father's education[e]	2.101	1.017
Educational experience		
Senior (vs. sophomore or junior)	.417	.493
Grade-point average[c]	2.995	.652
Courses completed in high school		
Elementary algebra	.635	.482
Geometry	.379	.485
Intermediate algebra	.328	.470
Trigonometry	.109	.311
Military interest		
Intends to enlist (vs. negative)	.594	.491

[a]For test equation, N = 8426. For high AFQT equation, N = 2041 test-takers.

[b]Uses 4-point scale: 1 = almost impossible; 4 = not difficult at all.

[c]Uses 3-point scale: 2 = mostly C's and below; 4 = mostly A's and B's

[d] y positive intention = says definitely or probably will be ser ...g in the military in the next few years and made unaided mention of plans to join the military; somewhat positive intention = says definitely or probably will be serving in the military but made no unaided mention; negative intention = says will probably not or definitely not be serving in the military, or is unsure whether will be serving.

[e]Uses 4-point scale: 1 = not high school graduate; 2 = high school graduate; 3 = some college; 4 = college graduate.

Table A.5

SUPPLEMENTAL VARIABLE INFORMATION FOR RESPONDENTS NOT IN HIGH SCHOOL

Variable	Mean	Standard Deviation
I. TEST EQUATION $(\alpha_1 + \beta_1 X_1)$ [a]		
Background characteristics		
Race (vs. white, non-Hispanic)		
Black	.106	.308
Other nonwhite	.047	.211
Age (vs. 16–18)		
Age 19	.279	.449
Age 20	.208	.406
Age 21	.167	.373
Resides in the South	.365	.481
Economic factors		
Current job status (vs. employed full-time and not attending college)		
Employed part-time, not attending college	.070	.256
Looking for work, not attending college	.128	.334
Out of labor force, not attending college	.031	.173
Employed full-time, attending college	.034	.182
Employed part-time, attending college	.113	.316
Looking for work, attending college	.033	.179
Out of labor force, attending college	.066	.248
Perceived ease of finding full-time employment[b]	2.801	.915
Educational experience		
High school dropout[c]	.193	.395
Military interest		
Intention to enlist (vs. negative)[d]		
Very positive	.025	.157
Somewhat positive	.164	.370
Had recruiter contact	.595	.491
Talked to parents about enlisting	.350	.477

Table A.5—continued

Variable	Mean	Standard Deviation
II. HIGH AFQT EQUATION ($\alpha_2 + \beta_2 X_2$) [a]		
Background characteristics		
Race (vs. white, non-Hispanic)		
Black	.199	.400
Other nonwhite	.064	.245
Resides in the South	.381	.486
Father's education[e]	2.017	.995
Economic factors		
Employed full-time, not attending college	.476	.500
Employed part-time, not attending college	.087	.282
Educational experience		
Current status (vs. high school diploma graduate not in college)		
Attending college	.180	.384
Attending college, employed full-time	.029	.169
High school dropout	.278	.448
High school grade-point average[f]	2.891	.695
Courses completed in high school		
Elementary algebra	.653	.476
Geometry	.432	.496
Intermediate algebra	.398	.490
Trigonometry	.181	.385
Military interest		
Intends to enlist (vs. negative)	.356	.479

[a]For test equation, N = 8907. For high AFQT equation, N = 1434 test-takers.

[b]Uses 4-point scale: 1 = almost impossible; 4 = not difficult at all.

[c]Did not graduate from high school.

[d]Very positive intention = says definitely or probably will be serving in the military in the next few years and made unaided mention of plans to join the military; somewhat positive intention = says definitely or probably will be serving in the military but has made no unaided mention; negative intention = says will probably not or definitely not be serving in the military, or is unsure whether will be serving.

[e]Uses 4-point scale: 1 = not high school graduate; 2 = high school graduate; 3 = some college; 4 = college graduate.

[f]Uses 3-point scale: 2 = mostly C's and below; 4 = mostly A's and B's.

Table A.6

COMPARISON OF ACTUAL AND ESTIMATED PERCENTAGE DISTRIBUTIONS FOR FALL 1976–1980 YATS RESPONDENTS TAKING AFQT: ADDITIONAL CHARACTERISTICS[a]

Characteristic	Percentage Distribution of Category I-IIIA AFQT-Takers			
	In High School at Survey		Not in High School at Survey	
	Actual Distribution (N = 889)	Estimated Distribution (N = 2041)	Actual Distribution (N = 590)	Estimated Distribution (N = 1434)
Age				
Age 16	45.6	43.1	3.2	2.5
Age 17	46.0	48.4	4.2	5.6
Age 18	8.0	7.8	35.1	33.4
Age 19	0.3	0.6	28.2	28.2
Age 20	0.1	0.1	17.1	17.0
Age 21	0.0	0.0	12.2	13.3
Father's education				
Less than high school gradua..	21.4	22.5	25.2	25.0
High school graduate	45.2	43.3	40.0	40.7
Some college	10.8	11.0	13.9	13.7
College graduate or more	22.6	23.2	20.9	20.6
Perceived ease of finding full-time employment				
Almost impossible	13.6	13.7	9.3	11.2
Very difficult	24.1	26.0	22.6	24.2
Somewhat difficult or don't know	48.1	45.3	43.7	40.1
Not difficult at all	14.2	15.0	24.4	24.5
Year in high school (high school students only)				
Sophomore	9.5	11.7	0.0	0.0
Junior	43.5	41.3	0.0	0.0
Senior	47.0	47.0	0.0	0.0

Table A.6—continued

Characteristic	Percentage Distribution of Category I-IIIA AFQT-Takers: In High School at Survey, Actual Distribution (N = 889)	In High School at Survey, Estimated Distribution (N = 2041)	Not in High School at Survey, Actual Distribution (N = 590)	Not in High School at Survey, Estimated Distribution (N = 1434)
High school grade-point average				
A's and B's	31.7	31.0	27.6	27.3
B's and C's	53.9	55.1	58.0	58.4
C's and below	14.4	13.9	14.4	14.3
Math courses completed in high school				
Elementary algebra	76.6	76.5	79.2	79.1
Geometry	57.1	57.1	61.5	61.5
Intermediate algebra	47.0	47.0	57.3	57.2
Trigonometry	18.0	18.0	30.3	30.3
Intention to enlist in the military[b]				
Very positive	17.1	16.7	5.9	5.6
Somewhat positive	34.2	34.6	17.8	18.3
Negative	48.7	48.7	76.3	76.1
Had recruiter contact	52.8	53.4	74.4	74.6
Talked to parents about enlisting	61.9	62.2	55.4	55.2

[a]The "actual distribution" percentages represent the characteristics of persons who actually received AFQT scores in categories I-IIIA. The "estimated distribution" percentages are based on the characteristics of all AFQT-takers; each test-taker's results are weighted by his estimated probability of scoring in categories I-IIIA.

[b]Very positive intention = says definitely or probably will be serving in the military in the next few years and made unaided mention of plans to join the military; somewhat positive intention = says definitely or probably will be serving in the military but made no unaided mention; negative intention = says will probably not or definitely not be serving in the military, or is unsure whether will be serving.

Table A.7

COMPARISON OF ACTUAL AND ESTIMATED PERCENTAGE DISTRIBUTIONS FOR SPRING 1976–1980 YATS RESPONDENTS TAKING AFQT: ADDITIONAL CHARACTERISTICS[a]

Characteristic	Percentage Distribution of Category I-IIIA AFQT-Takers			
	In High School at Survey		Not in High School at Survey	
	Actual Distribution (N = 909)	Estimated Distribution (N = 1987)	Actual Distribution (N = 468)	Estimated Distribution (N = 1118)
Age				
Age 16	44.9	42.1	2.8	2.6
Age 17	40.3	43.7	7.3	5.8
Age 18	13.3	12.5	23.3	22.9
Age 19	1.5	1.4	31.8	31.8
Age 20	0.0	0.3	22.6	24.4
Age 21	0.0	0.0	12.2	12.5
Father's education				
Less than high school graduate	16.9	19.4	25.0	23.1
High school graduate	45.2	44.8	38.0	39.9
Some college	12.4	11.7	14.5	13.5
College graduate or more	25.5	24.1	22.5	23.5
Perceived ease of finding full-time employment				
Almost impossible	11.0	11.3	9.8	12.5
Very difficult	26.8	28.0	20.8	21.1
Somewhat difficult or don't know	45.8	44.2	42.5	41.9
Not difficult at all	16.4	16.5	26.9	24.5
Year in high school (high school students only)				
Sophomore	23.3	23.7	0.0	0.0
Junior	45.0	44.9	0.0	0.0
Senior	31.7	31.4	0.0	0.0

Table A.7—continued

Characteristic	Percentage Distribution of Category I-IIIA AFQT-Takers			
	In High School at Survey		Not in High School at Survey	
	Actual Distribution (N = 909)	Estimated Distribution (N = 1987)	Actual Distribution (N = 468)	Estimated Distribution (N = 1118)
High school grade-point average				
A's and B's	30.7	29.7	30.3	31.0
B's and C's	55.1	56.1	53.9	53.6
C's and below	14.2	14.2	15.8	15.4
Math courses completed in high school				
Elementary algebra	73.7	75.9	80.8	80.2
Geometry	52.9	55.8	56.8	58.3
Intermediate algebra	49.9	50.0	54.7	53.8
Trigonometry	16.6	17.0	27.4	29.0
Intention to enlist in the military[b]				
Very positive	14.1	13.1	6.0	5.2
Somewhat positive	37.1	36.6	21.4	20.6
Negative	48.8	50.3	72.6	74.2
Had recruiter contact	57.4	58.3	73.1	74.6
Talked to parents about enlisting	66.9	66.0	54.3	52.7

[a]The "actual distribution" percentages represent the characteristics of persons who actually received AFQT scores in categories I-IIIA. The "estimated distribution" percentages are based on the characteristics of all AFQT-takers; each test-taker's results are weighted by his estimated probability of scoring in categories I-IIIA.

[b]Very positive intention = says definitely or probably will be serving in the military in the next few years and made unaided mention of plans to join the military; somewhat positive intention = says definitely or probably will be serving in the military but made no unaided mention; negative intention = says will probably not or definitely not be serving in the military, or is unsure whether will be serving.

Table A.8

PARAMETER ESTIMATES FOR FEMALE RESPONDENTS IN HIGH SCHOOL

Factor	Parameter Estimate	t-statistic[a]
HIGH AFQT EQUATION ($\alpha_2 + \beta_2 X_2$)		
Intercept	−2.0870	− 2.85
Background characteristics		
Racial minority (vs. white, non-Hispanic)	− .4805	− 1.93
Age 16 or 17 (vs. 18)	.2815	0.80
Resides in the South	− .0677	− 0.28
Father's education[b]	.1108	0.94
Educational experience		
Grade-point average[c]	.3258	1.69
Courses completed in high school		
Elementary algebra	.2157	0.69
Geometry	.6461	2.72
Intermediate algebra	.3952	1.68
Military interest		
Intends to enlist (vs. negative)	− .3879	− 1.65

[a] t-statistics with an absolute value of 1.96 or greater indicate that the corresponding parameter estimate differs significantly from zero (at the $p < .05$ level). N = 158.

[b] Uses 4-point scale: 1 = not high school graduate; 2 = high school graduate; 3 = some college; 4 = college graduate.

[c] Uses 3-point scale: 2 = mostly C's and below; 4 = mostly A's and B's.

[d] Positive intention = says definitely or probably will be serving in the military in the next few years; negative intention = says will probably not or definitely not be serving in the military, or is unsure whether will be serving.

For female high school students, the trigonometry variable present in the men's AFQT equation was excluded due to its extremely small cell size and "other nonwhite" was combined with "black" for the same reason. Among women, service policy makes nongraduates ineligible to enlist. As a result, they test at a lower rate than would be expected from the men's results (chi-square = 33.69, df = 1, $p < .0001$ in our sample). This pattern also affects high school students, since sophomores and juniors who drop out of high school—and thus sophomores and juniors in general—test at a lower rate than would be expected (chi-square = 5.95, df = 1, $p < .02$ in our sample). Although inclusion of a "senior" term in the equation improves the match with actual high aptitude rates for senior versus junior/sophomore AFQT examinees, we believe it biases the results for the population as a whole. Therefore, we have excluded it.

Table A.9

PARAMETER ESTIMATES FOR FEMALE RESPONDENTS NOT IN HIGH SCHOOL

Factor	Parameter Estimate	t-statistic[a]
HIGH AFQT EQUATION ($\alpha_2 + \beta_2 X_2$)		
Intercept	−2.6386	− 4.29
Background characteristics		
Racial minority (vs. white, non-Hispanic)	−1.0883	− 4.71
Resides in the South	− .1290	− 0.62
Father's education[b]	.1118	1.06
Economic factors		
Employed, not attending college	.4524	1.99
Educational experience		
Attending college	.6496	2.29
High school grade-point average[c]	.5239	3.08
Courses completed in high school		
Elementary algebra	.6663	2.63
Geometry	.3679	1.63
Intermediate algebra	− .1999	− 0.87
Military interest		
Intends to enlist (vs. negative)[d]	− .4584	− 1.97

[a] t-statistics with an absolute value of 1.96 or greater indicate that the corresponding parameter estimate differs significantly from zero (at the $p < .05$ level). N = 232.

[b] Uses 4-point scale: 1 = not high school graduate; 2 = high school graduate; 3 = some college; 4 = college graduate.

[c] Uses 3-point scale: 2 = mostly C's and below; 4 = mostly A's and B's.

[d] Positive intention = says definitely or probably will be serving in the military in the next few years; negative intention = says will probably not or definitely not be serving in the military, or is unsure whether will be serving.

For women no longer in high school, the trigonometry variable was dropped and the race variables were combined because of small cell sizes, as noted above. The "dropout" variable present in the men's AFQT equation also had to be omitted, the two college variables combined, and the two employment variables combined for the same reason. We note in passing that among *women* not attending college, the results suggest that those having jobs score higher on the AFQT than those who are unemployed.

Table A.10

SUPPLEMENTAL VARIABLE INFORMATION FOR FEMALE RESPONDENTS IN HIGH SCHOOL

Variable	Mean	Standard Deviation
HIGH AFQT EQUATION ($\alpha_2 + \beta_2 X_2$) [a]		
Background characteristics		
Racial minority (vs. white, non-Hispanic)	.411	.494
Age 16 or 17 (vs. 18)	.867	.341
Resides in the South	.424	.496
Father's education[b]	2.025	1.028
Educational experience		
Grade-point average[c]	3.310	.667
Courses completed in high school		
Elementary algebra	.747	.436
Geometry	.392	.490
Intermediate algebra	.449	.499
Military interest		
Intends to enlist (vs. negative)[d]	.506	.502

[a] N = 158.

[b] Uses 4-point scale: 1 = not high school graduate; 2 = high school graduate; 3 = some college; 4 = college graduate.

[c] Uses 3-point scale: 2 = mostly C's and below; 4 = mostly A's and B's.

[d] Positive intention = says definitely or probably will be serving in the military in the next few years; negative intention = says will probably not or definitely not be serving in the military, or is unsure whether will be serving.

Table A.11

SUPPLEMENTAL VARIABLE INFORMATION FOR FEMALE RESPONDENTS NOT IN HIGH SCHOOL

Variable	Mean	Standard Deviation
HIGH AFQT EQUATION ($\alpha_2 + \beta_2 X_2$) [a]		
Background characteristics		
Racial minority (vs. white, non-Hispanic)	.341	.475
Resides in the South	.362	.482
Father's education[b]	1.918	.943
Economic factors		
Employed, not attending college	.457	.499
Educational experience		
Attending college	.220	.415
High school grade-point average[c]	3.198	.620
Courses completed in high school		
Elementary algebra	.694	.462
Geometry	.401	.491
Intermediate algebra	.422	.495
Military interest		
Intends to enlist (vs. negative)[d]	.267	.443

[a] N = 232.

[b] Uses 4-point scale: 1 = not high school graduate; 2 = high school graduate; 3 = some college; 4 = college graduate.

[c] Uses 3-point scale: 2 = mostly C's and below; 4 = mostly A's and B's.

[d] Positive intention = says definitely or probably will be serving in the military in the next few years; negative intention = says will probably not or definitely not be serving in the military, or is unsure whether will be serving.

Table A.12

COMPARISON OF PREDICTED AND ACTUAL AFQT RESULTS FOR FEMALE TEST-TAKERS IN FALL 1980–1981 YATS WAVES

Predicted Probability of Scoring in Categories I-IIIA	Actual Proportion Scoring in Categories I-IIIA		(Number)	
	High School Students	Respondents Not in High School	High School Students	Respondents Not in High School
$.66 < p \leq 1.00$	.74	.82	(23)	(50)
$.33 < p \leq .66$	.56	.49	(61)	(70)
$0 \leq p \leq .33$	.14	.13	(74)	(112)
			(158)	(232)

Table A.13

COMPARISON OF ACTUAL AND ESTIMATED PERCENTAGE DISTRIBUTIONS FOR 1980–1981 FEMALE YATS RESPONDENTS TAKING AFQT[a]

Characteristic	Percentage Distribution of Category I-IIIA AFQT-Takers			
	In High School at Survey		Not in High School at Survey	
	Actual Distribution (N = 61)	Estimated Distribution (N = 158)	Actual Distribution (N = 90)	Estimated Distribution (N = 232)
Region				
Northeast	16.4	15.5	27.8	30.1
North central	27.9	28.1	26.7	28.9
South	37.7	37.7	26.6	26.7
West	18.0	18.7	18.9	14.3
Employment status				
Employed full-time	8.2	5.7	38.9	43.1
Employed part-time	49.2	49.4	28.9	23.4
Looking for work	32.8	35.3	18.9	19.0
Out of labor force	9.8	9.6	13.3	14.5
Race				
White, non-Hispanic	72.1	71.8	87.8	87.8
Black	19.7	21.3	7.8	9.7
Other nonwhite	8.2	6.9	4.4	2.5
Educational status				
Not high school graduate	100.0	100.0	6.7	5.0
High school graduate, not attending college	0.0	0.0	62.2	64.2
High school graduate, attending college	0.0	0.0	31.1	30.8

Table A.13—continued

Characteristic	Percentage Distribution of Category I-IIIA AFQT-Takers			
	In High School at Survey		Not in High School at Survey	
	Actual Distribution (N = 61)	Estimated Distribution (N = 158)	Actual Distribution (N = 90)	Estimated Distribution (N = 232)
Age				
Age 16	36.1	35.7	0.0	0.1
Age 17	54.1	54.4	6.7	5.6
Age 18	9.8	9.5	27.8	25.7
Age 19	0.0	0.4	31.1	29.3
Age 20	0.0	0.0	16.6	21.3
Age 21	0.0	0.0	17.8	18.0
Father's education				
Less than high school graduate	18.0	26.3	24.4	26.1
High school graduate	47.5	35.8	50.0	47.1
Some college	14.8	14.2	8.9	9.7
College graduate or more	19.7	23.7	16.7	17.1
Perceived ease of finding full-time employment				
Almost impossible	19.7	17.9	11.1	13.8
Very difficult	32.8	33.6	30.0	31.2
Somewhat difficult or don't know	34.4	36.3	43.3	38.4
Not difficult at all	13.1	12.2	15.6	16.7
Year in high school (high school students only)				
Sophomore	3.3	5.0	0.0	0.0
Junior	39.3	34.9	0.0	0.0
Senior	57.4	60.1	0.0	0.0
High school grade-point average				
A's and B's	57.4	58.7	43.3	46.8
B's and C's	41.0	37.8	55.6	48.6
C's and below	1.6	3.5	1.1	4.7

Table A.13—continued

Characteristic	Percentage Distribution of Category I-IIIA AFQT-Takers			
	In High School at Survey		Not in High School at Survey	
	Actual Distribution (N = 61)	Estimated Distribution (N = 158)	Actual Distribution (N = 90)	Estimated Distribution (N = 232)
Courses complete in high school				
Elementary algebra	86.9	87.4	85.6	85.4
Geometry	59.0	58.7	54.4	54.4
Intermediate algebra	62.3	62.2	52.2	51.9
Trigonometry	14.8	21.4	16.7	15.6
Intention to enlist in the military[b]				
Very positive	8.2	10.7	2.2	3.3
Somewhat positive	29.5	27.1	16.7	15.6
Negative	62.3	62.2	81.1	81.1
Had recruiter contact	47.5	52.5	60.0	64.1
Talked to parents about enlisting	68.8	59.0	41.1	42.7

[a]The "actual distribution" percentages represent the characteristics of persons who actually received AFQT scores in categories I-IIIA. The "estimated distribution" percentages are based on the characteristics of all AFQT-takers; each test-taker's results are weighted by her estimated probability of scoring in categories I-IIIA.

[b]Very positive intention = says definitely or probably will be serving in the military in the next few years and made unaided mention of plans to join the military; somewhat positive intention = says definitely or probably will be serving in the military but made no unaided mention; negative intention = says will probably not or definitely not be serving in the military, or is unsure whether will be serving.

QUALITY-BASED PROFILE OF 1985 MALE YATS RESPONDENTS

Table A.14 provides estimated percentage distributions for category I-IIIA and category IIIB-V youths on a variety of important background characteristics. Separate results are presented for three school groups: high school graduates, seniors, and younger high school students. Table A.15 lists the results of the logistic regression analyses that are the basis for Tables 15 and 16.

Table A.14

ESTIMATED PERCENTAGE DISTRIBUTIONS FOR 1985 YATS RESPONDENTS[a]

	High School Status and AFQT Category					
	High School Graduates (N = 2127)		High School Seniors (N = 883)		Younger High School Students (N = 1166)	
	Category		Category		Category	
Characteristic	I-IIIA	IIIB-V	I-IIIA	IIIB-V	I-IIIA	IIIB-V
Region						
Northeast	26.4	21.4	25.4	20.6	23.7	19.7
North central	24.4	24.3	22.9	21.0	28.4	21.9
South	29.0	36.8	28.2	41.8	28.8	38.8
West	20.2	17.5	23.5	16.6	19.1	19.6
Employment status						
Employed full-time	46.2	60.3	8.1	11.3	5.2	7.4
Employed part-time	27.1	18.1	42.1	39.7	35.2	28.2
Looking for work	13.1	14.9	20.8	28.8	29.9	42.2
Out of labor force	13.6	6.7	29.0	20.2	29.7	22.2
Race						
White, non-Hispanic	89.2	62.7	85.0	60.2	86.4	67.2
Black	3.7	21.7	5.6	26.0	3.2	15.8
Other nonwhite	7.1	15.6	9.4	13.8	10.4	17.0
Educational status						
No high school diploma	0.0	0.0	100.0	100.0	100.0	100.0
High school diploma, not in college	55.6	79.1	0.0	0.0	0.0	0.0
High school diploma, in college	44.4	20.9	0.0	0.0	0.0	0.0
Age						
Age 16	0.3	0.1	15.2	13.9	81.1	72.3
Age 17	3.9	3.5	74.9	57.2	17.5	22.2
Age 18	30.8	21.2	8.9	24.9	1.1	4.5
Age 19	27.6	27.1	0.9	3.3	0.2	0.7
Age 20	19.4	24.9	0.1	0.6	0.1	0.3
Age 21	18.1	23.2	0.0	0.1	0.0	0.0
Father's education						
Less than high school graduate	14.0	22.9	9.4	18.9	9.5	18.4
High school graduate	48.3	58.4	43.9	55.8	47.0	57.4
Some college	13.0	8.5	14.3	11.2	11.2	8.3
College graduate or more	24.7	10.2	32.4	14.1	32.3	15.9

Table A.14—continued

Characteristic	High School Status and AFQT Category					
	High School Graduates (N = 2127)		High School Seniors (N = 883)		Younger High School Students (N = 1166)	
	Category		Category		Category	
	I-IIIA	IIIB-V	I-IIIA	IIIB-V	I-IIIA	IIIB-V
Perceived ease of finding full-time employment						
Almost impossible	7.3	9.9	4.9	7.9	9.0	13.5
Very difficult	20.8	22.3	21.0	22.6	19.5	22.9
Somewhat difficult or don't know	43.6	44.2	51.2	49.9	48.5	44.5
Not difficult at all	28.3	23.6	22.9	19.6	23.0	19.1
High school grade-point average						
A's and B's	28.7	14.1	36.6	15.1	36.2	17.7
B's and C's	57.1	58.3	50.3	54.0	50.2	51.5
C's and below	14.2	27.6	13.1	30.9	13.6	30.8
Courses completed in high school						
Elementary algebra	89.2	71.0	93.4	72.1	87.3	62.2
Geometry	72.6	43.4	82.3	42.6	71.4	34.0
Intermediate algebra	67.4	40.0	76.5	40.4	57.5	25.9
Trigonometry	42.0	16.3	45.4	13.6	19.8	4.8
Intention to enlist in the military[b]						
Very positive	1.2	4.7	5.2	10.7	5.5	8.5
Somewhat positive	6.7	17.1	14.5	26.7	21.5	33.2
Negative	92.1	78.2	80.3	62.6	73.0	58.3
Had recruiter contact	50.0	51.8	38.1	42.3	20.5	25.4
Talked to parents about enlisting	13.8	14.9	24.7	23.4	22.1	23.3

[a]Entries are estimated percentages for male respondents ages 16–21 years, based on their predicted probability of scoring in the indicated AFQT categories and their YATS sample weight.

[b]Very positive intention = says definitely or probably will be serving in the military in the next few years and made unaided mention of plans to join the military; somewhat positive intention = says definitely or probably will be serving in the military but made no unaided mention; negative intention = says will probably not or definitely not be serving in the military, or is unsure whether will be serving.

Table A.15

LOGISTIC REGRESSION COEFFICIENTS: AWARENESS OF ARMY BONUS AND EDUCATIONAL BENEFIT PROGRAMS[a]

Program	High School Graduates	High School Seniors	Younger High School Students
Enlistment bonus			
(Number of cases)	(1168)	(528)	(688)
Factor			
Intercept	−1.60	−2.11	−2.07
Broadcast advertising	.04	−.33	−.26
Print advertising	.37	.36	.41
Recruiting literature	−.02	.73	1.19
Recent recruiter contact	.87	.61	.77
Educational benefit			
(Number of cases)	(959)	(355)	(478)
Factor			
Intercept	.35	.20	−.49
Broadcast advertising	.14	−.02	.18
Print advertising	.27	.12	.85
Recruiting literature	.13	.54	.28
Recent recruiter contact	.53	1.33	1.30

[a]Significance level information for the coefficients is provided in Tables 15 and 16.

TESTS FOR SIGNIFICANCE OF DIFFERENCES IN QUALITY-BASED ANALYSIS[1]

Comparisons of means between school groups—e.g., positive propensity level for high school graduates versus seniors or for category I-IIIA graduates versus category I-IIIA seniors—are relatively straightforward. The error term in such comparisons needs to be adjusted for the weighting of the sample. The variance of the mean of a weighted variable is:

$$var(\bar{X}w) = \text{var}(X)\,\frac{\sum w_j^2}{\left(\sum w_j\right)^2}$$

[1]This section was prepared by Robert Bell of RAND.

where $\bar{X}w$ = mean of weighted variable, and
w_j = weight for respondent j.

The weight for an individual respondent equals his sample weight (if any) or the product of his sample weight times the estimated probability he will score in a given AFQT category, depending on whether the analysis compares school groups or an AFQT category within school groups—e.g., graduates versus seniors or category I-IIIA graduates versus category I-IIIA seniors.[2] The formula for the t-test of the significance of the difference between two such means is:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{S_1^2 + S_2^2}} \text{ with } df = n_1 + n_2 - 2$$

where $\bar{X}_i = \dfrac{\sum_j w_{ij} X_{ij}}{\sum_j w_{ij}}$,

S_i^2 = var (X_{ij}) $\dfrac{\sum w_{ij}^2}{(\sum w_{ij})^2}$, and

n_i = number of cases in group i.

Performing significance tests of the difference in the means estimated for the AFQT category subgroups within a given school group—e.g., for category I-IIIA graduates versus category IIIB-V graduates—is somewhat more complicated. The added complexity arises because the two point estimates are generated from the same respondents and from the same data points. In one case, an individual's response is weighted by his estimated probability of scoring in categories I-IIIA, and in the second case, by his estimated probability of scoring in categories IIIB-V (which equals one minus the first

[2]When the AFQT estimation technique is used to estimate the proportion or number of category I-IIIA youths in a population of interest, similar logic applies. The variance of the estimated proportion equals:

$$\text{var } (p_j) \frac{\Sigma s_j^2}{(\Sigma s_j)^2}$$

where p_j = predicted probability person j would score in categories I-IIIA, and
s_j = sample weight for person i.

The variance of the estimated number of category I-IIIA youths in a population of size N equals N^2 times the variance of the estimated proportion of category I-IIIA youths.

probability). As a result, the difference of the point estimates can be expressed as:

$$\bar{X}w_1 - \bar{X}w_2 = \frac{\sum_j w_{1j}X_j}{\sum_j w_{1j}} - \frac{\sum_j w_{2j}X_j}{\sum_j w_{2j}}$$

where $w_{1j} = p_j s_j$,

$w_{2j} = (1 - p_j)\, s_j$,

p_j = estimated probability of scoring in categories I-IIIA, and

s_j = sample weight for respondent j .

Let $N_1 = \sum_j w_{1j}$

$N_2 = \sum_j w_{2j}$

$N = N_1 + N_2 = \sum_j s_j$

$\bar{p} = \frac{\sum_j p_j s_j}{\sum_j s_j}$.

Then $\bar{X}w_1 - \bar{X}w_2 = \frac{\sum_j w_{2j} \sum_j w_{1j}X_j - \sum_j w_{1j} \sum_j w_{2j}X_j}{\sum_j w_{ij} \sum_j w_{2j}}$

$$= \frac{N_2 \sum_j w_{1j}X_j - N_1 \sum_j w_{2j}X_j}{N_1 N_2}$$

$$= \sum_j \left(\frac{N_2 w_{1j} - N_1 w_{2j}}{N_1 N_2} \right) X_j$$

$$= \sum_j \left(\frac{N_2 p_j s_j - N_1 (1 - p_j) s_j}{N_1 N_2} \right) X_j$$

$$- \sum_j \left(\frac{(N_2 + N_1)\, p_j s_j - N_1 s_j}{N_1 N_2} \right) X_j$$

$$- \sum_j \left(\frac{N p_j - N_1}{N_1 N_2} \right) s_j X_j$$

$$- \sum_j \left(\frac{N(p_j - \bar{p})}{N_1 N_2} \right) s_j X_j \ .$$

The variance of this difference can be expressed as:

$$\text{var}\ (\bar{X}w_1 - \bar{X}w_2) = S^2 = \sum_j \frac{N^2\ (p_j - \bar{p})^2}{N_1^2\ N_2^2}\ s_j^2\ \text{var}\ (X)$$

$$- \frac{N^2}{N_1^2\ N_2^2}\ \text{var}\ (X)\ \sum_j (p_j - \bar{p})^2\, s_j^2$$

and the test of the significance of the difference equals

$$t = \frac{\bar{X}w_1 - \bar{X}w_2}{S} \quad \text{with } df = n - 1$$

where n = number of cases in given school group.[3]

[3]Var (X) refers to the variance of X for the given school group. The last equality treats $(p_j - \bar{p})\, s_j$ as nonrandom. This assumption is not fully satisfied in that p_j is predicted. However, the error from making this assumption is negligible.

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